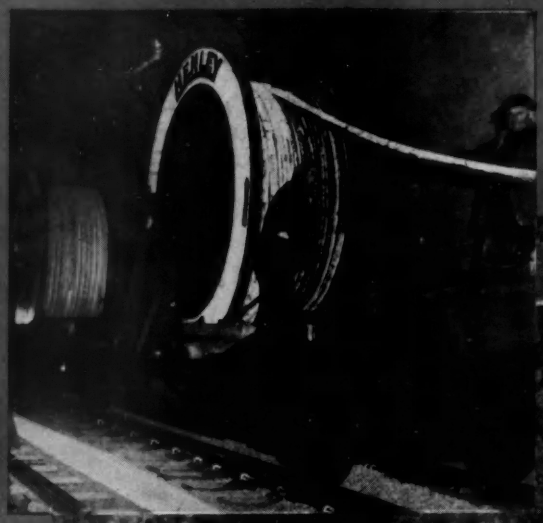
2 SEPTEMBER 1954 NINEPENCE

ELECTRICAL TIMES



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BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

Let Henley Cables carry the current

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

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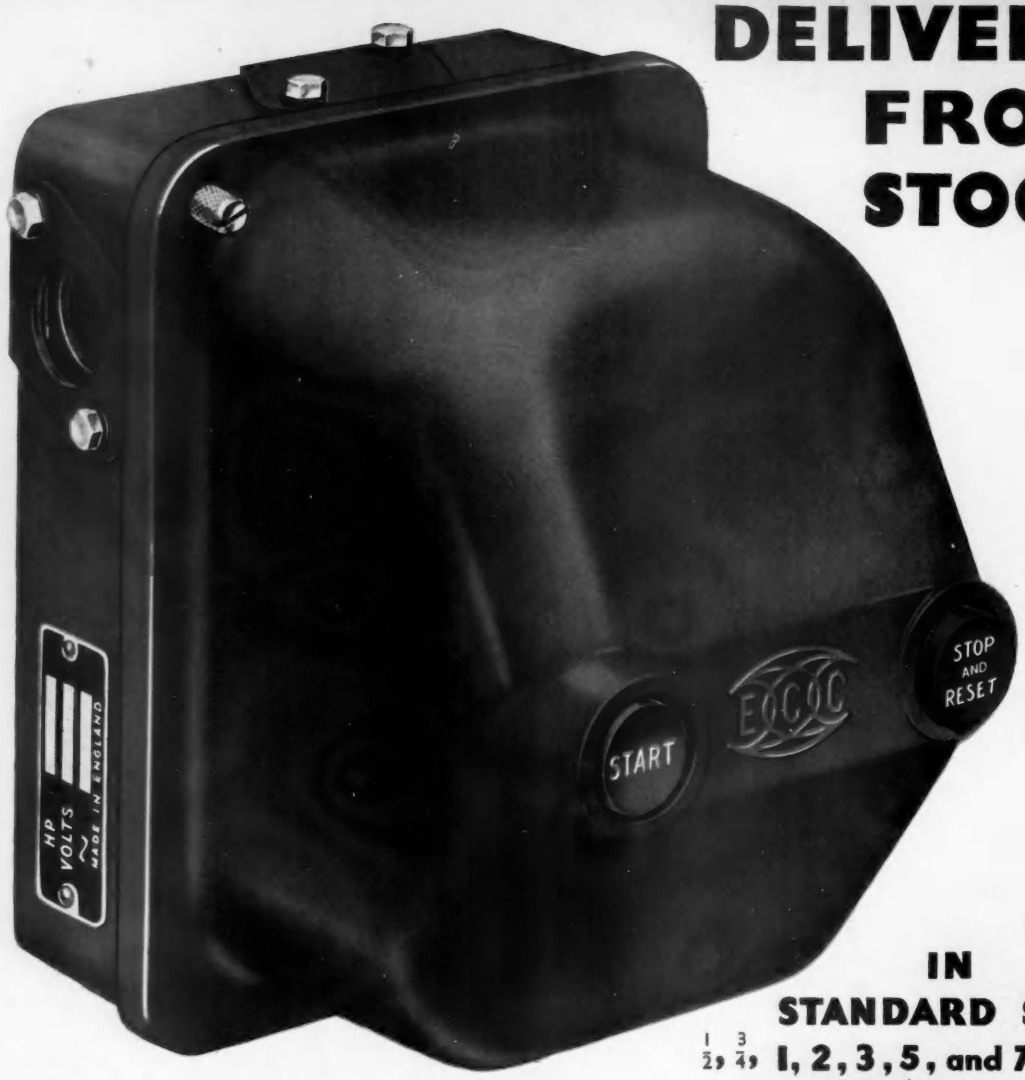

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Available also for non-standard voltages.

Brochure S.205 available on Request

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Manufacturers of Rotating Electrical Machinery, Switch and Control Gear, Rectifiers and Transformers.

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Standard transformers for rural electrification

AVAILABLE ON SHORT DELIVERY

'ENGLISH ELECTRIC' transformers for pole or platform mounting, and of the substation type to British Electricity Specification T.1, are available for quick delivery.

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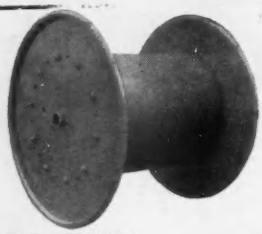
WOOD

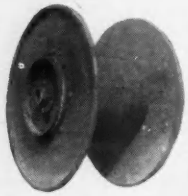
AND STEEL

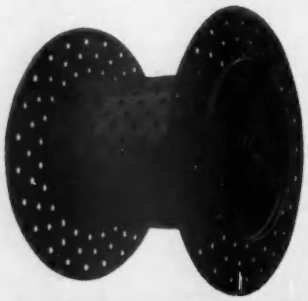
REELS OF EVERY



KIND

FOR THE ELECTRIC WIRE AND CABLE TRADE





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The Continent with expanding Markets

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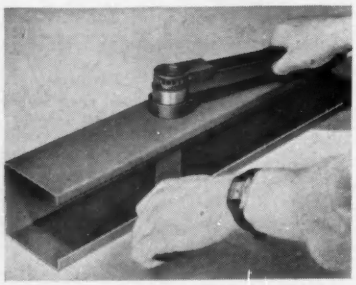

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A portable press tool for punching holes up to 2"

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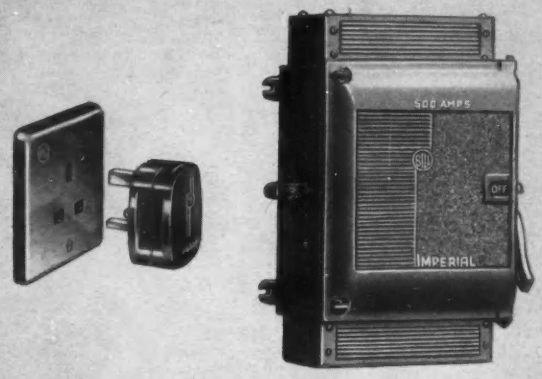

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13 AMP SOCKET OUTLET TO 500 AMP FUSE SWITCH

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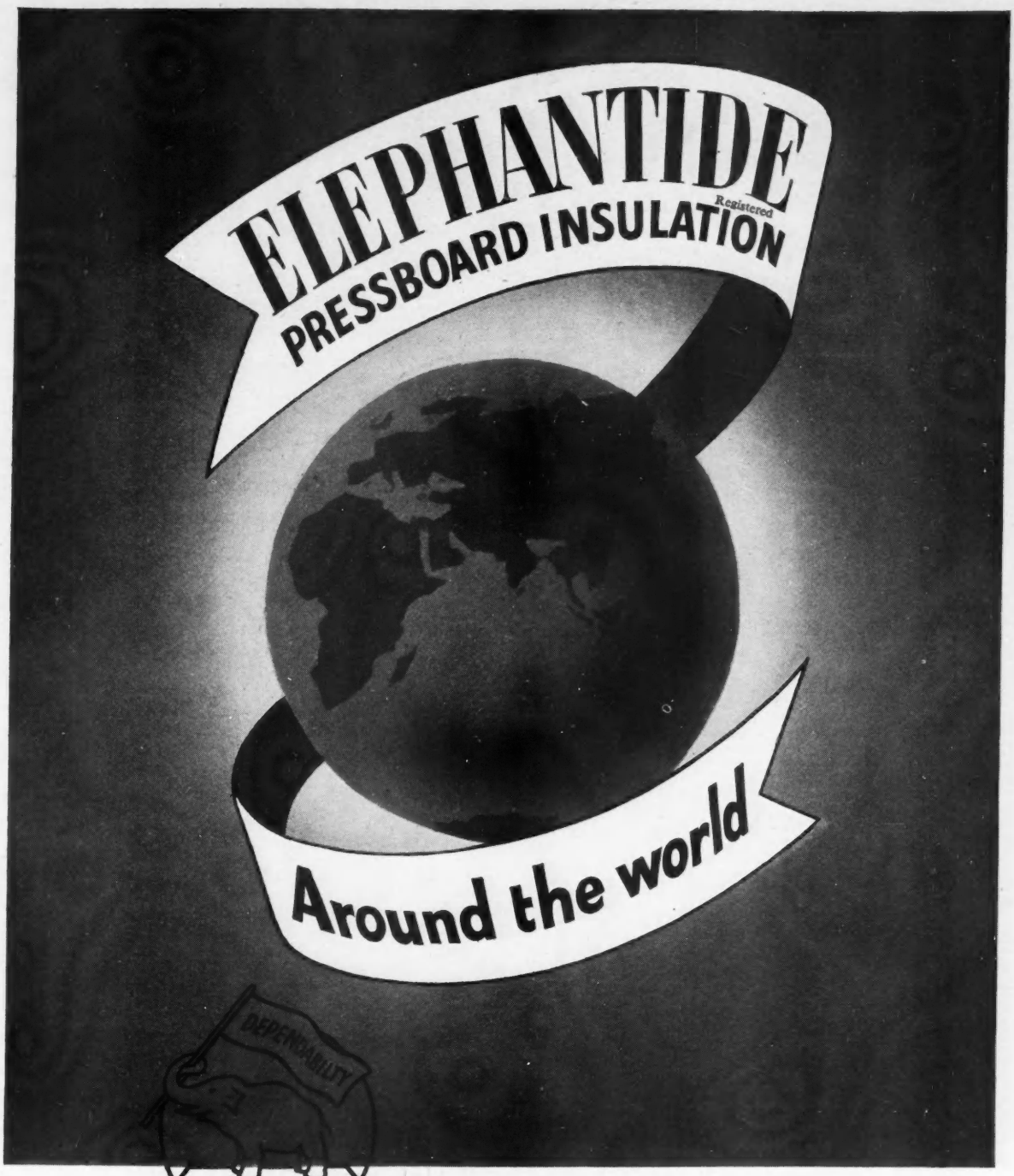

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To TRICITY COOKERS LTD., 109 Kingsway, London, WC2

Please send coloured brochure and address of nearest stockist.

NAME ..... R.T.2.

ADDRESS .....

Tricity

Finished in natural ivory or white enamel, handles and controls maroon—other colours on request.

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How often have you been asked for Tricity Cookers . . . Our advertisements in the "Radio Times", remember, appear consistently throughout the year . . . Make sure you are ready for the demand; not *some*-time but ***now.***

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Lovely to look at : Built-in Auto-Time Control : Cooks much faster : Longer heat retention : Bigger oven : Lower current consumption : Precise temperature control everywhere

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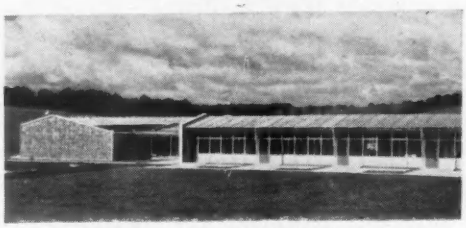
Hundreds of installations prove that

PANELEC IS CHEAPER TO INSTALL AND OPERATE



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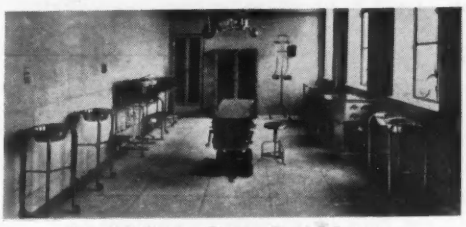
Willerby & Co. Ltd., Tailors, Southampton.



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The capital cost of a complete system of PANELEC electric floor warming is on average only two-thirds that of ordinary central heating.

PANELEC's ability to take full advantage of the thermal characteristics of the building in which it is incorporated, ensures considerable savings in operating costs by comparison with any alternative method of heating of equal duty, fired by either coal, coke, gas or oil. This saving is even more marked when PANELEC is arranged for "off peak" operation and advantage taken of reduced tariffs now being offered by many Electricity Supply Authorities. Further savings are effected in annual labour costs, repairs, maintenance, depreciation and insurance.

Moreover—PANELEC heating is clean, safe, efficient, and the healthiest of all forms of heating.

The installations listed left are a small selection from the many hundreds on which the superiority of PANELEC heating has been demonstrated. Our engineers will be glad to give you further proof.

ELECTRIC LOW TEMPERATURE RADIANT FLOOR WARMING

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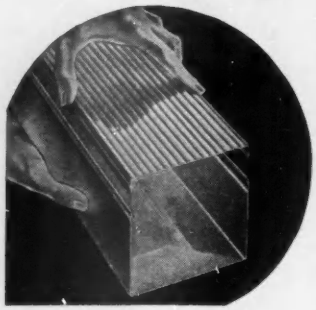
CHANNEL "Spring Capped" CONDUIT



If you would like to know about the many advantages of Channel Conduit please write or 'phone for descriptive pamphlet R.A.14.

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For portable m/c tools, hand lamps etc., Secondary Voltages from 12 V—110 V. Capacities from 50 V.A. to 750 V.A.

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For testing earth fault loop resistance—2 models available.

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MULTIPLY PRODUCTION

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F.H.P. FOR YOUR JOB
Soundly constructed in top grade Materials and of first class workmanship.

IMMEDIATE DELIVERY of
UNIVERSAL MOTORS D.C. MOTORS
1/100—1/6 h.p. 1/50—1/4 h.p.
THREE PHASE GEARED UNITS
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SINGLE PHASE, SPLIT PHASE & CAPACITOR MOTORS 1/50—1/20 h.p.
TORQUE UP TO 300 lbs/ins

We are also manufacturers of Domestic and Trade Sewing Machine Motors. Write NOW for details of our full range to Dept. E.22. Our Advisory Engineer is at your service.

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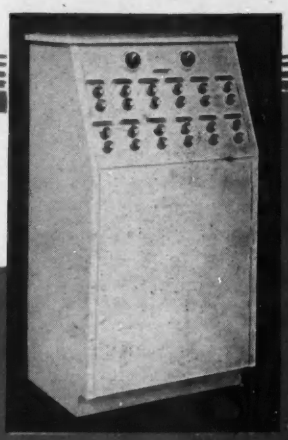
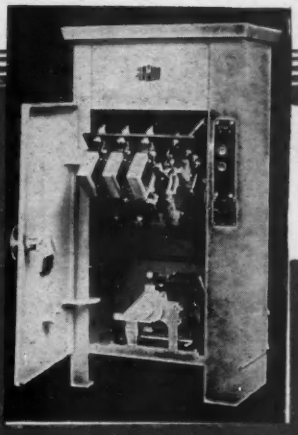
Cables: HILLMANCO LONDON. Telephone: AMHerst 5274/5

Remote Control Desk for group motor starting with indicator lamps.

A variety of arrangements is available to suit individual requirements.



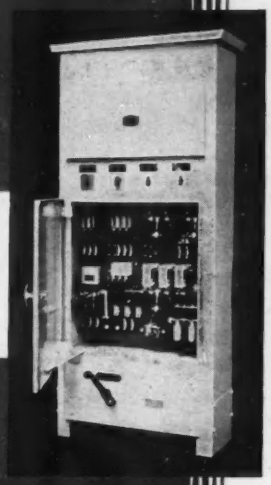


Type DO.75 Single Pillar motor starter showing accessibility of interior (isolator shield removed).

Fitted with local push-buttons and "Local Remote" rotary selector switch.

Type M.150 Contactor Unit suitable for direct mounting on Capacitor tank for power factor correction.

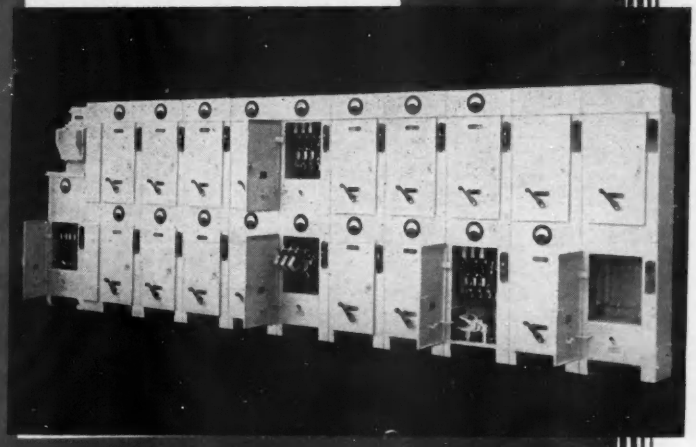
Pillar-type motor starter incorporating three direct-on starters and one stator rotor starter arranged for automatic sequence control and fitted with isolating switch.



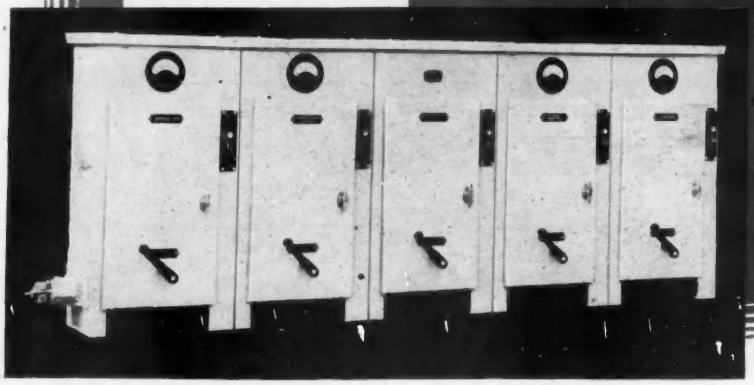
22 Unit Double Tier motor control switchboard comprising 300 amp. incoming switch and fuse unit, and contactors catering for various duties up to 100 H.P.

AIR BREAK ELECTRIC MOTOR CONTROL GEAR

FOR INDUSTRIAL APPLICATION
(up to 650 volts A.C.)



Single Tier motor control switchboard with individual isolation, ammeters and arranged for local push-button control.



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BELLSHILL
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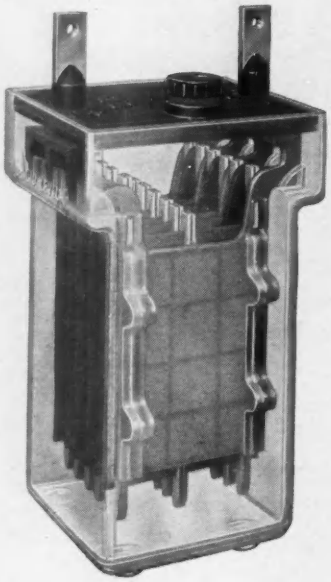
LONDON OFFICE: COLUMBIA HOUSE, ALDWYCH. W.C.2

DP Stationary batteries

65 years have passed since the first D.P. battery was made

Every D.P. battery produced to-day embodies the wide experience gained during this long period devoted exclusively to the manufacture of batteries for all purposes.



The two examples illustrated are a sealed type 75 ampere-hour cell as used for emergency lighting and power stations, and a large 10,200 ampere-hour cell in a wood lead-lined box.

Sizes of Planté batteries manufactured and installed by this company, range in capacity from 10 to 13,000 ampere-hours.

THE D.P. BATTERY CO., LTD., BAKEWELL, DERBYSHIRE

'Phone : Bakewell 81 LONDON: 66, VICTORIA ST., S.W.1 'Phone: Victoria 9661/2

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A distinctive new design combining all the features you have asked for

the **Plateswitch**

the Plateswitch fits into the background of modern decoration

the compact 2-gang unit has the same dimensions as the 1-gang

INSTALLATION is simpler . . . speedier. Both one and two gang switches have 2⅜" fixing centres. The fixed plate ensures automatic levelling with the plaster. A range of boxes gives a choice of cable and conduit entries.

THE ACTION is positive, yet can be controlled in silence. Contacts are balanced for maximum pressure with minimum stress, giving trouble-free performance and long life. The movement is factory-sealed and requires no maintenance.

THE COST is remarkably low — right in line for the most competitive housing work. For example, the ivory **Plateswitch** costs less than you usually pay for brown.

THESE FEATURES SIMPLIFY STOCKING

Every **Plateswitch** is supplied with four screws to match — two 4BA for metal boxes and two No. 5 wood screws for wood boxes.

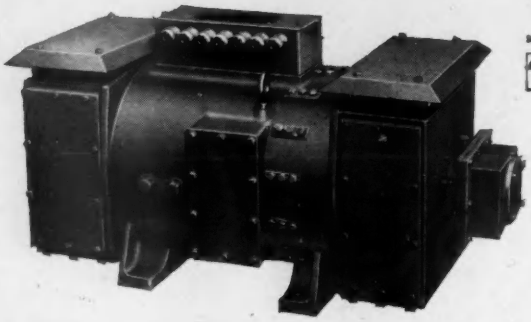
The two gang **Plateswitch** has two 2-way switches only, each or both of which can be wired as 1-way.

Leaflet 227 illustrates the range in full colour.

MK ... the mark of leadership

M.K. Electric Limited, Wakefield Street, Edmonton, London N.18. Edmonton 5151

NEWTON-DERBY
ELECTRICAL EQUIPMENT



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2½ kVA Motor Alternator, Drip proof to 45°. Motor 220 volts D.C. Output 120 volts, 3 phase, 333 cycles per second. Motor includes an automatic constant speed governor. Weight 450 lb.

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(Send for publication No. 1003/2)

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SMART & BROWN (ENGINEERS) LIMITED

FLUORESCENT LIGHTING

Smart & Brown offer the complete Fluorescent Lighting Service....

No. WB 14 (Single 4 ft. lamp)
also available for other size lamps.

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INVITE YOU TO EXAMINE THE WIDE RANGE OF

ELECTRIC[illegible] AND ACCESSORIES

DISPLAYED ON STANDS I & Ia AVENUE G AT THE

SCOTTISH INDUSTRIES EXHIBITION

KELVIN HALL, GLASGOW
SEPT. 2nd – 18th, 1954

SCOTTISH CABLES LIMITED

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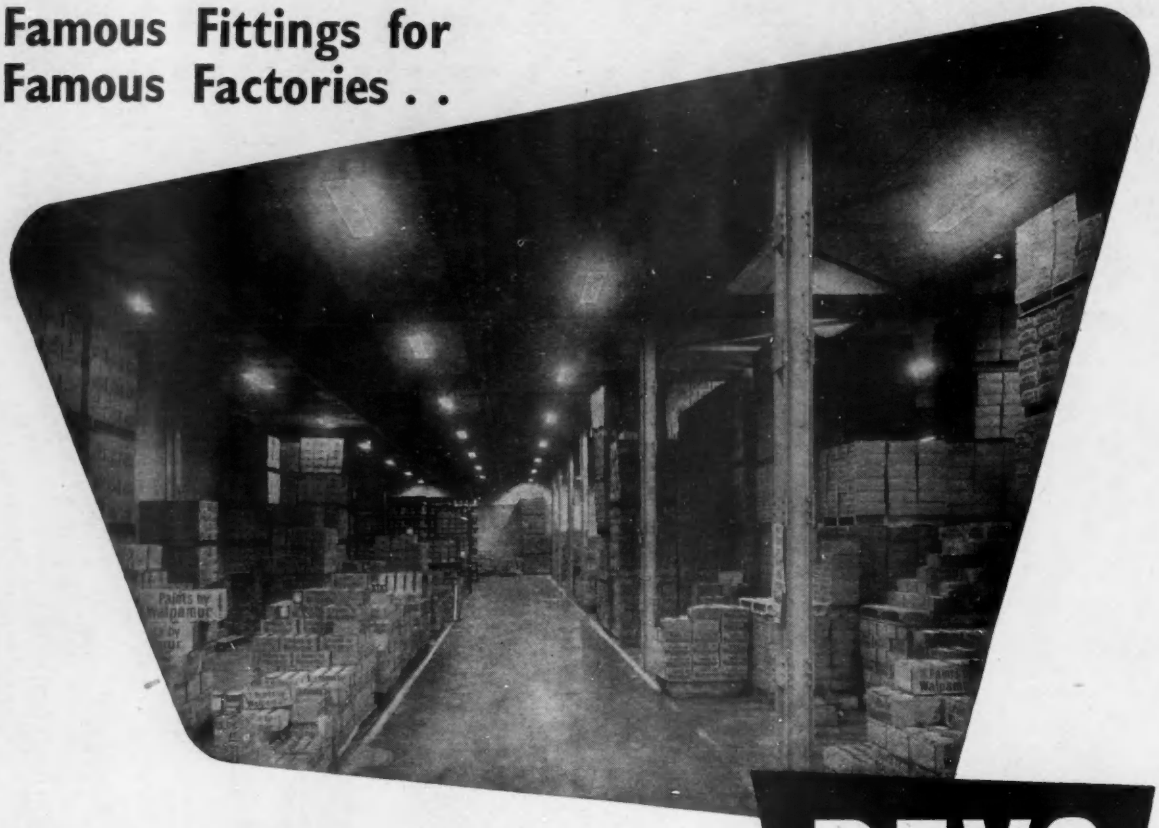
Associated Company: SCOTTISH CABLES (SOUTH AFRICA) LTD. PIETERMARITZBURG, NATAL

Famous Fittings for Famous Factories . .



WALPAMUR chooses

REVO REGD.

TRUFOLITE REFLECTOR FITTINGS

Like many other important manufacturers, the Walpamur Co. Ltd. selected Revo Fluorescent Fittings for the efficient lighting of their premises at Darwen.
Over 400 fittings have been installed in the factory and offices and the accompanying photograph shows a section of the stock room and forwarding department where the well-known Revo "Trufolite" units have been installed, each using one 5 ft. 80 watt fluorescent lamp.

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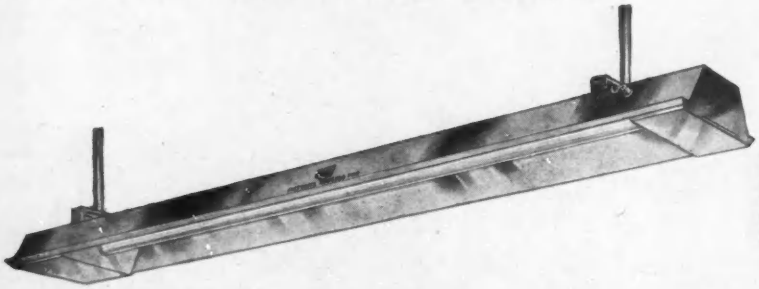
The services of the Revo Lighting Department are available to clients and the company's engineers will be pleased to advise on any lighting problem or prepare schemes for proposed installations without obligation.



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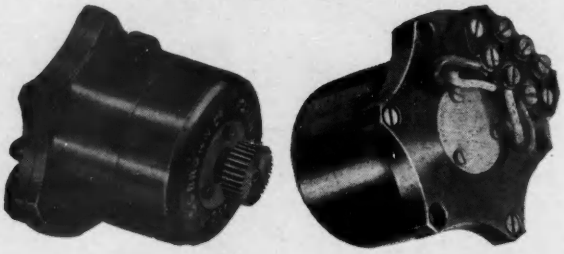

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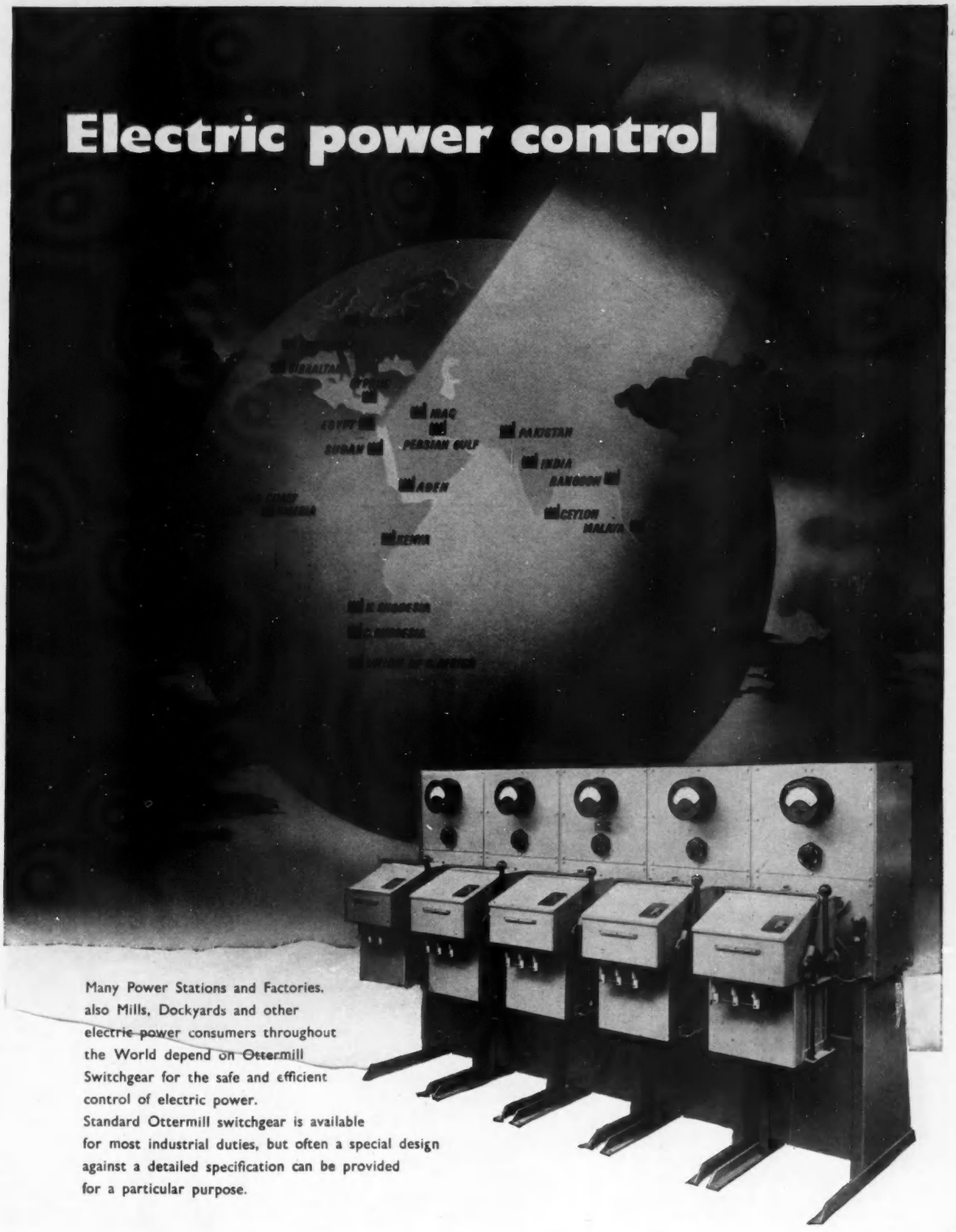

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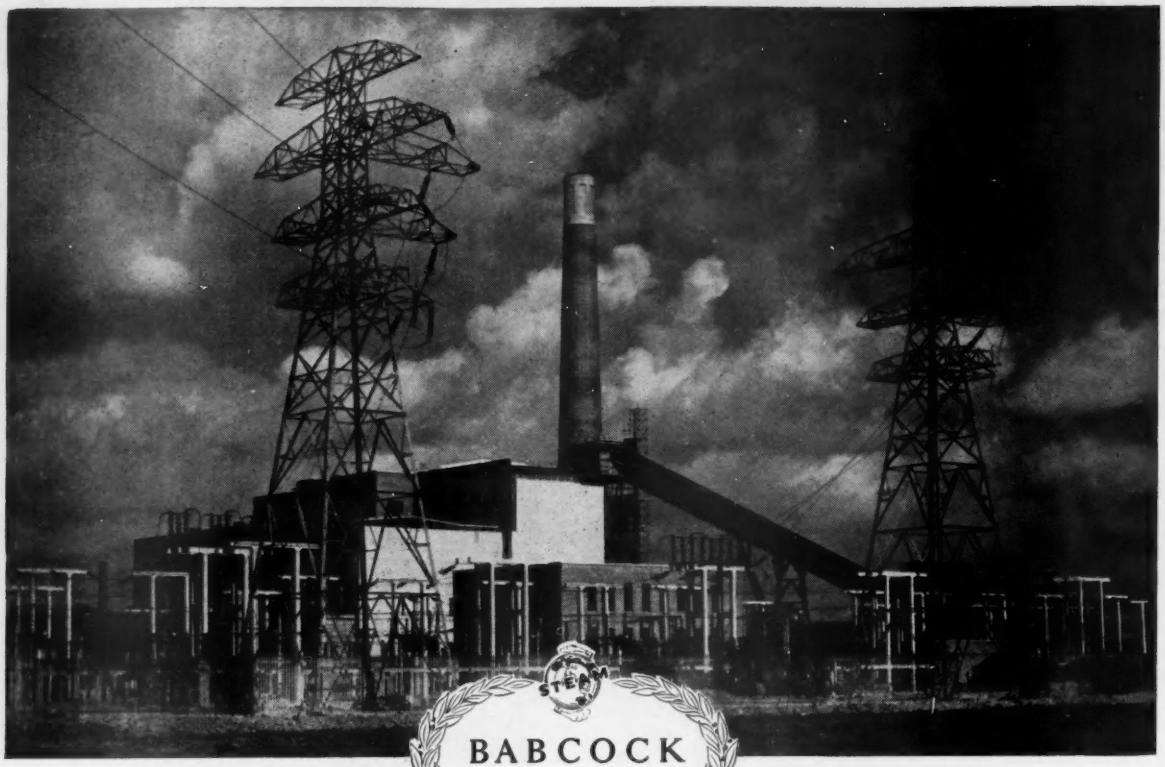

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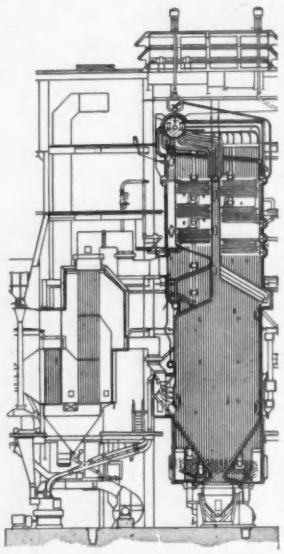
The Babcock boilers at the new 240 MW. Carrington power station are Radiant units, each with an evaporation of 360,000 lb./hr. at 940 lb./sq. in. and 920°F., and fired with pulverized coal by means of eight horizontal intertube burners.

The contract includes all the coal pulverizing plant, comprising 28 Babcock type E mills to feed seven boilers.



Ash, collected in the 'A' type water-filled hoppers is discharged to sump by the "*Hydrojet*" system, being pumped to settling ponds by "*Hydroseal*" ash pumps. Dust is extracted from the precipitator and air-heater hoppers by the "*Hydrovac*" system. All this is Babcock equipment, widely used in both power station and industrial installations.

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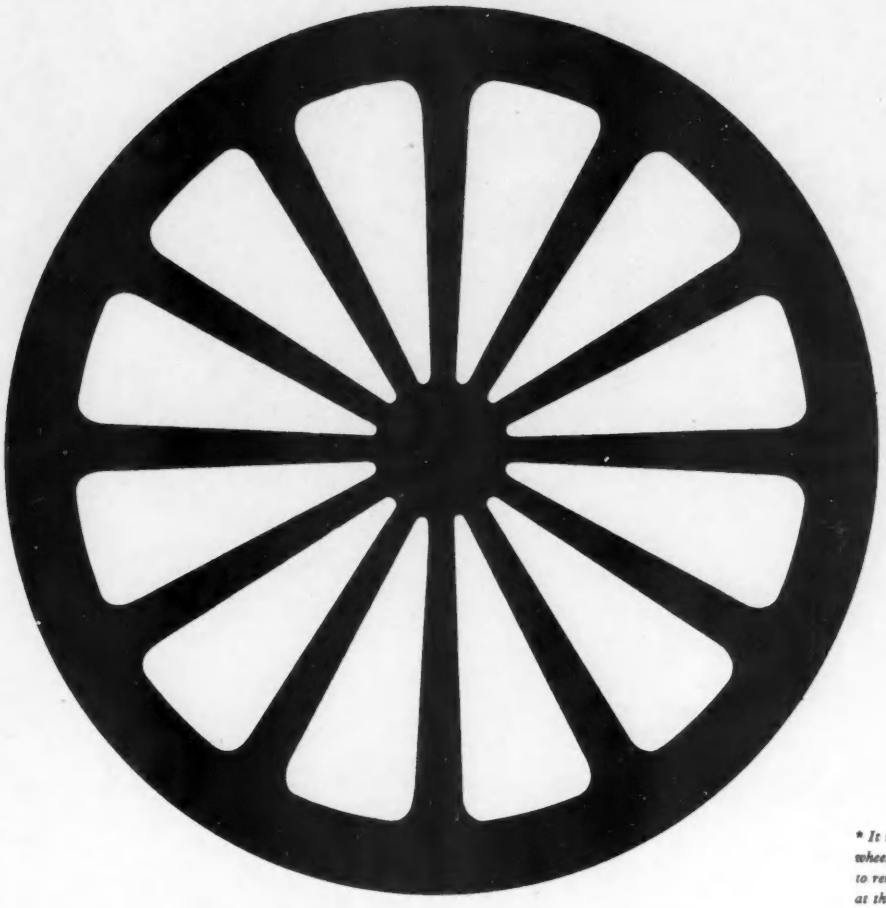

** It is unnatural for any wheel connected with Crompton Parkinson to remain still. Blink steadily at this one and watch it revolve.*

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Within the seventy-five year old Crompton Parkinson organisation are a number of separate entities. Each is responsible for the manufacture of an essential piece of electrical plant—each is a vital spoke in a mighty wheel that, in turn, keeps the wheels of your industry turning. Yet each entity, though complete in itself, is but part of a common whole — the Crompton Parkinson service to a modern world.

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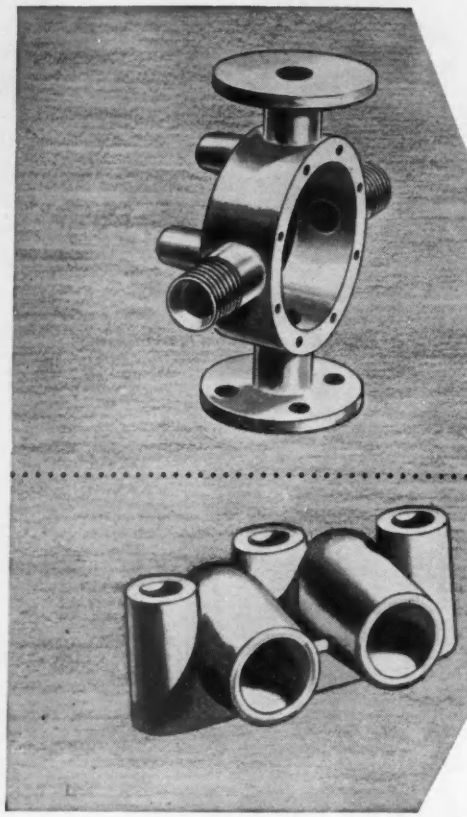

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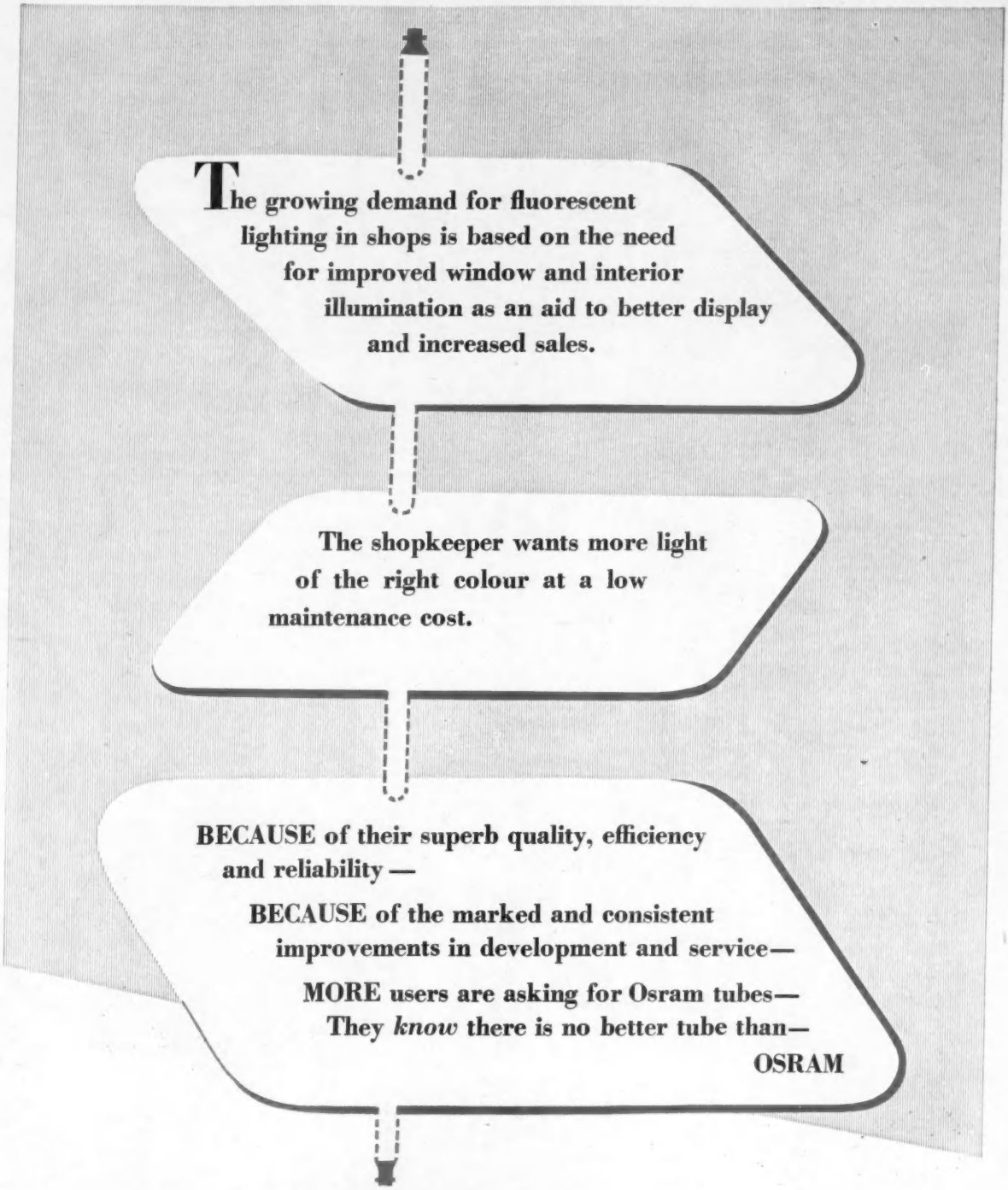

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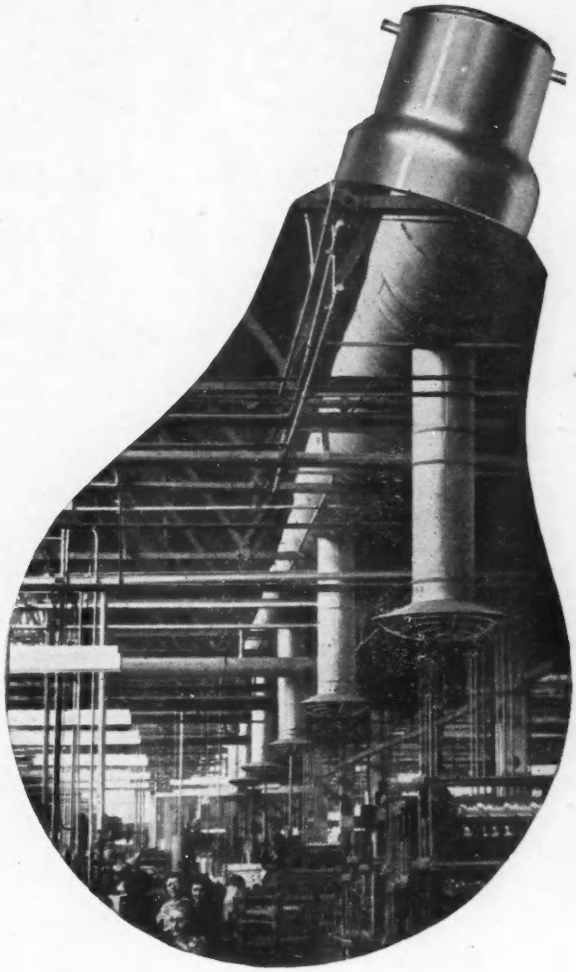

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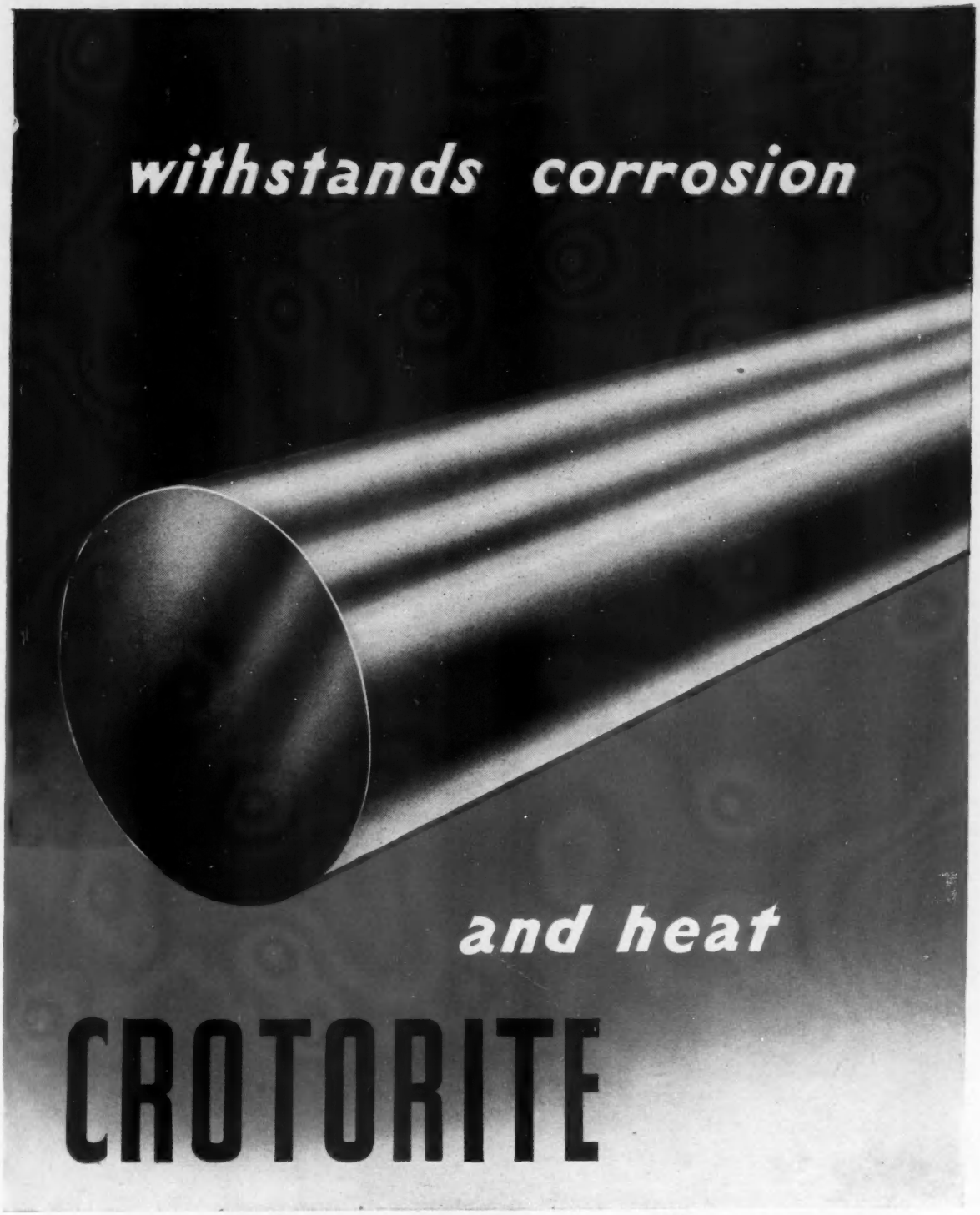

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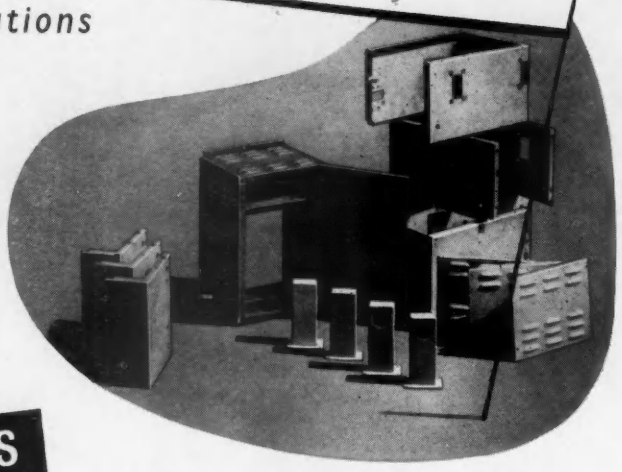

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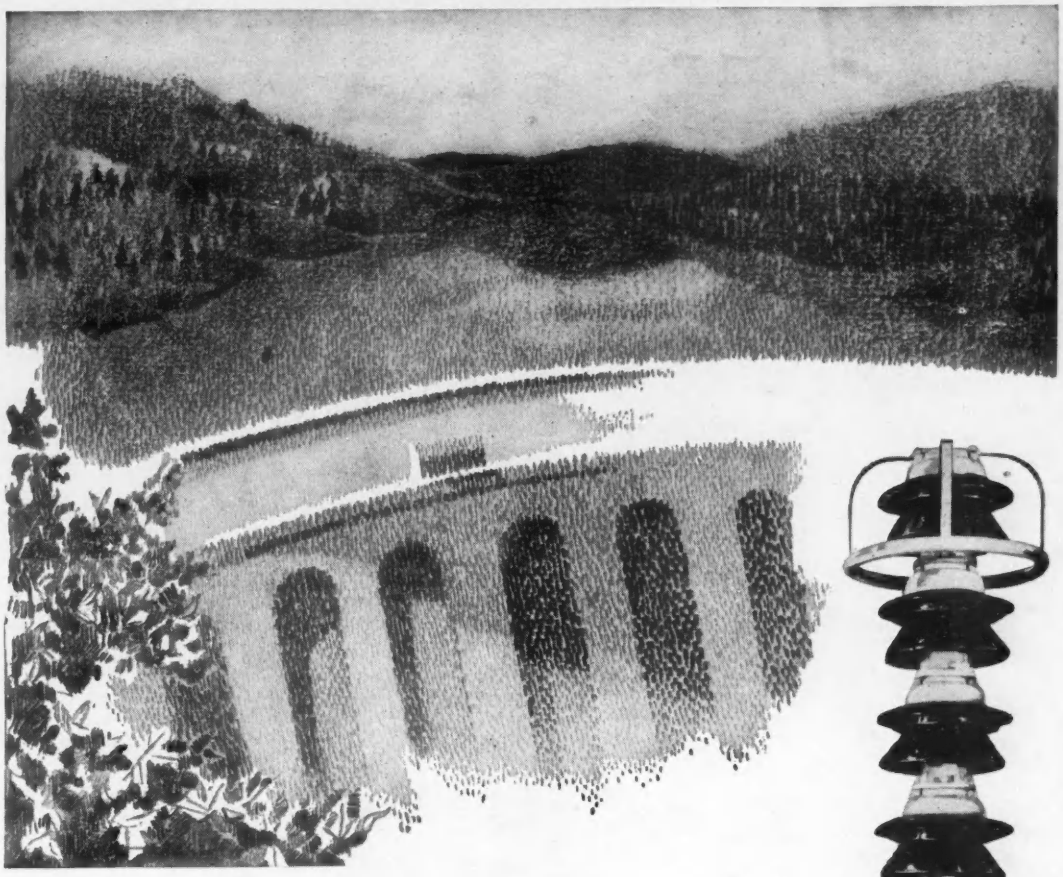

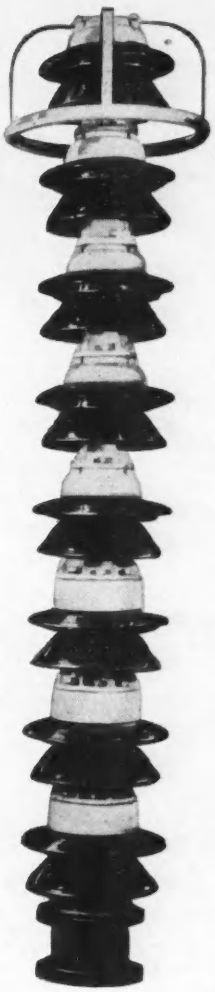

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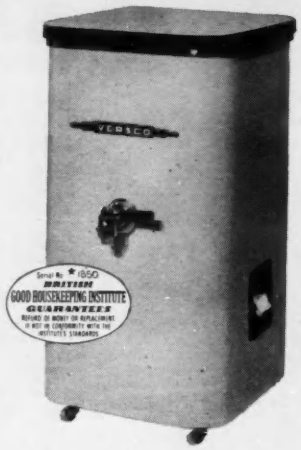

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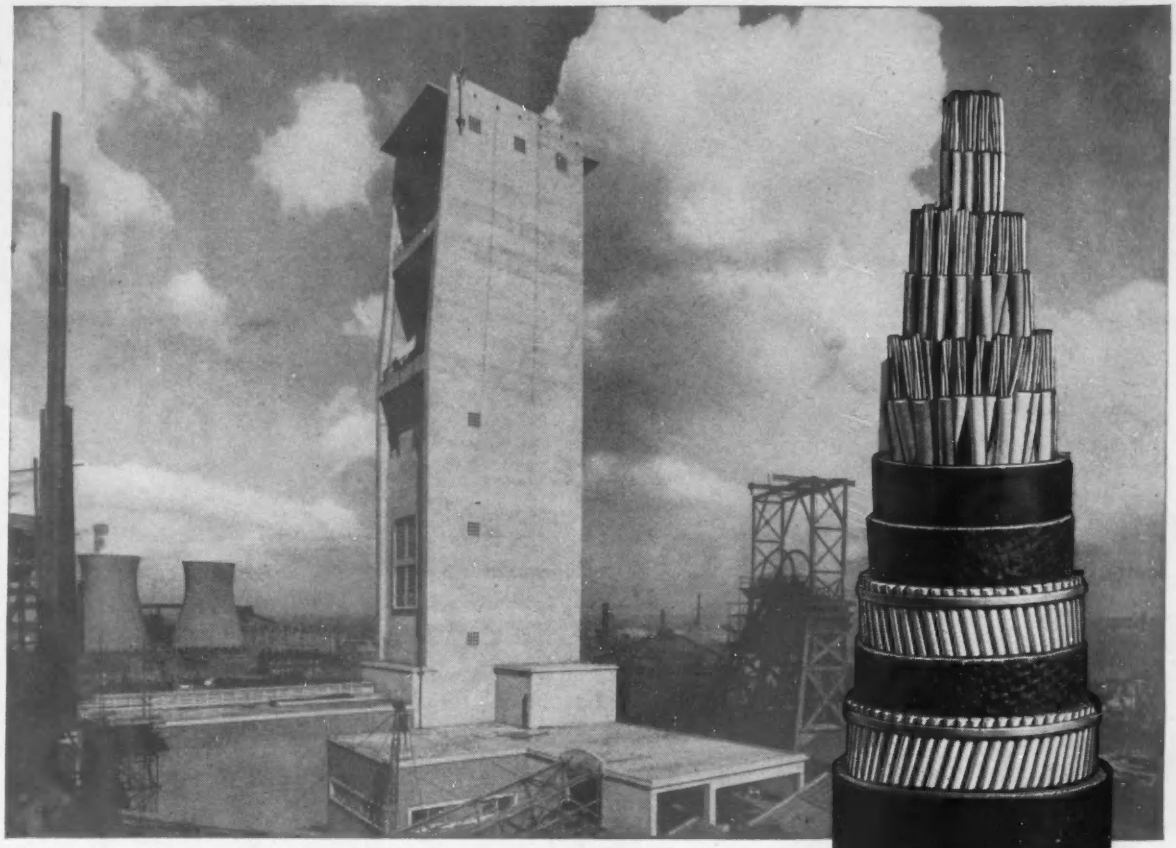

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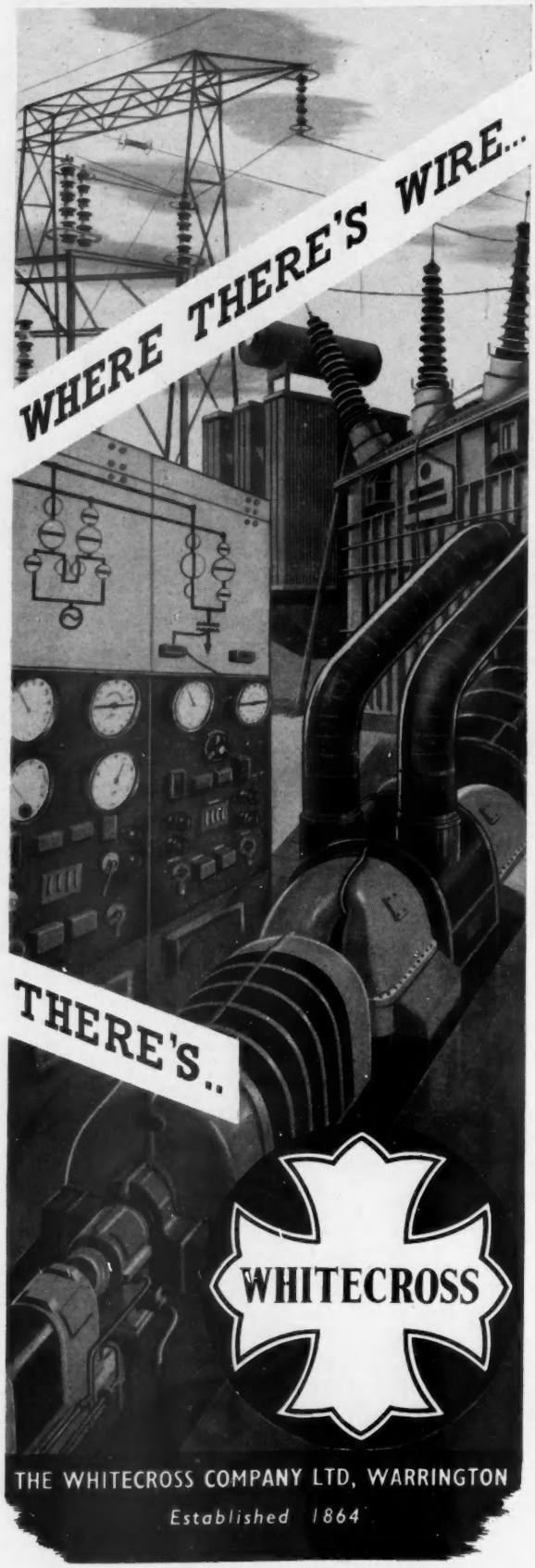

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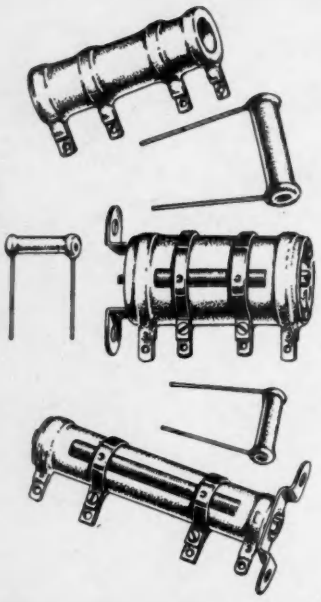

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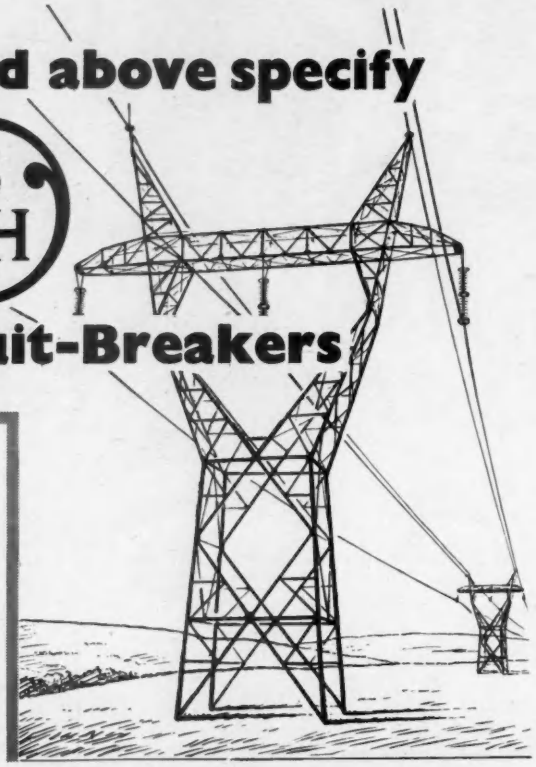

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Three-phase line dropping tests ranging from 17 miles to 387 miles.

The breaking of magnetising and reactor currents; tests from 10 amperes to 100 amperes without surge diverters.

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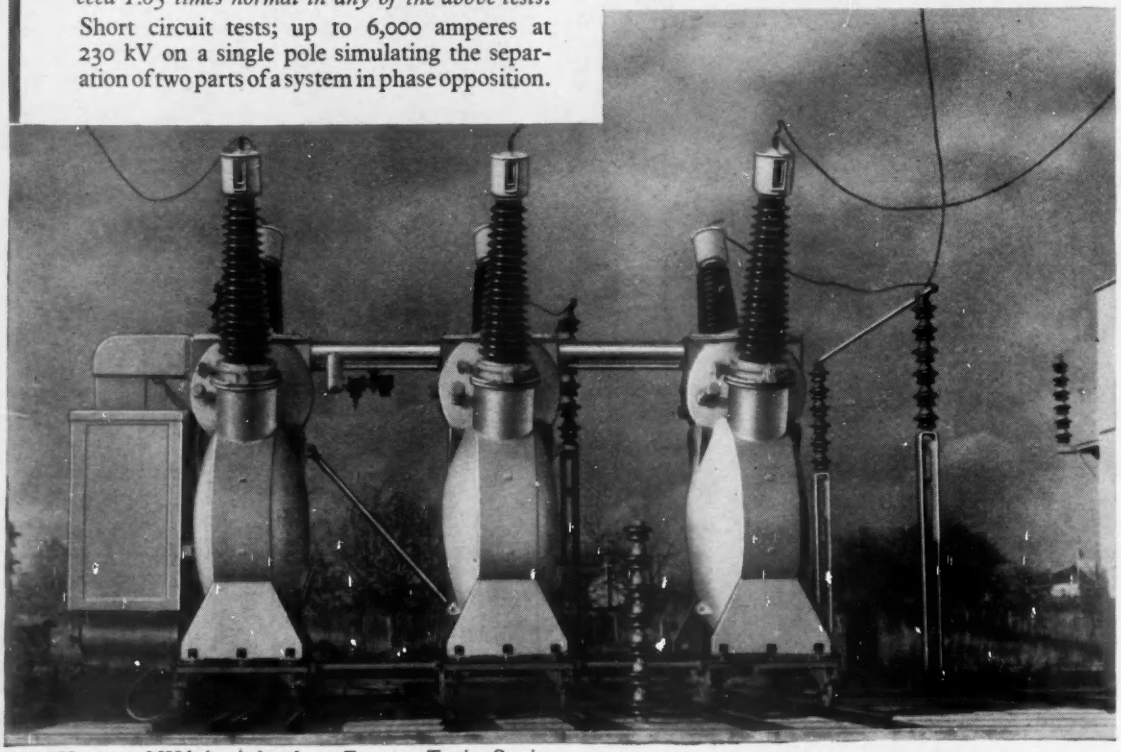

220-kV, 5,000-MVA circuit-breaker at Fontenay Testing Station

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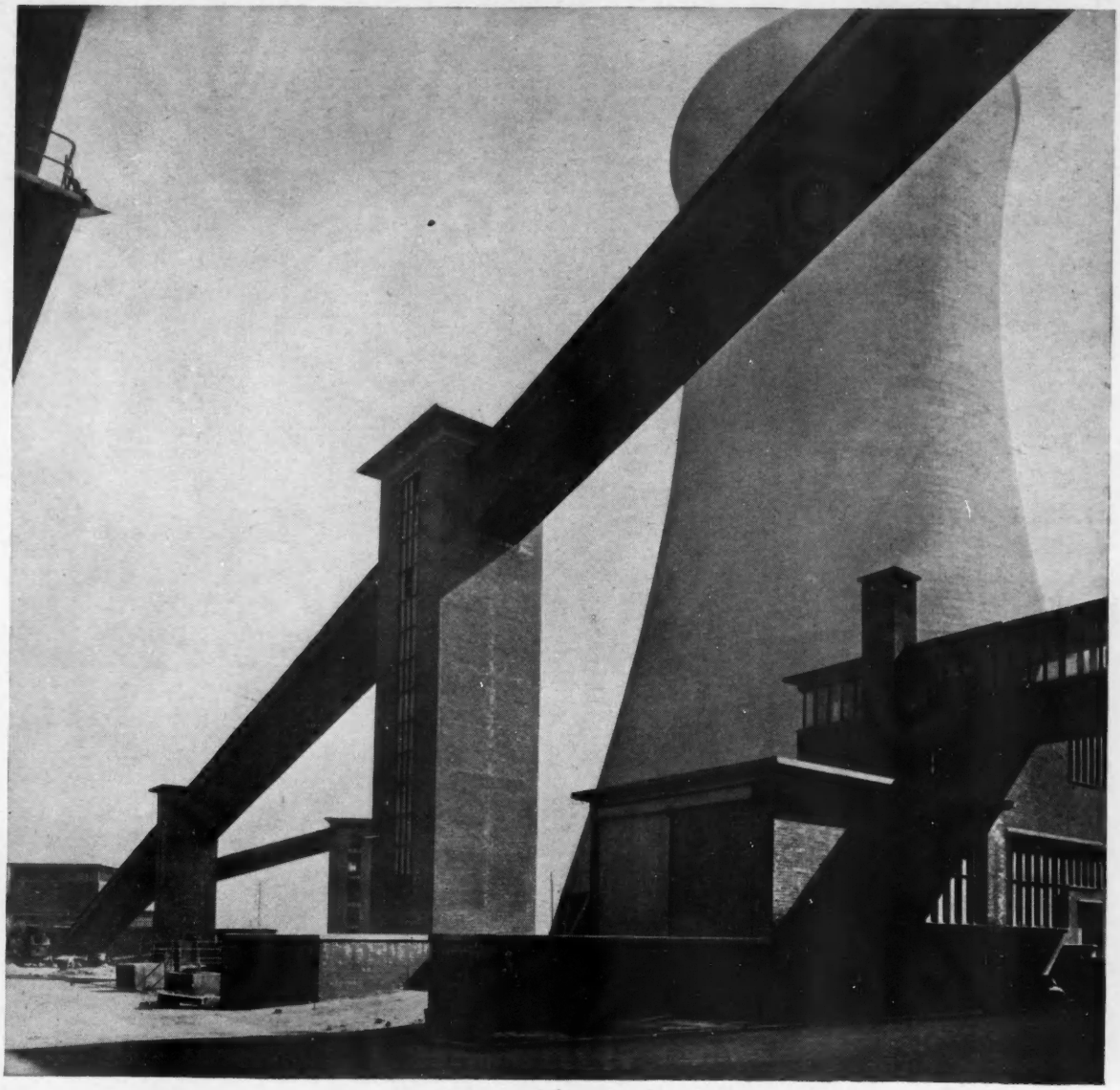
A4776



DESIGNED FOR EFFICIENT HANDLING

Now in commission at the Huncoat (Accrington) power station, this coal handling plant is one of many designed and built by Simon-Carves at home and abroad. Wide experience of the mechanical and pneumatic handling of coal, coke breeze, and many other fuels qualifies Simon-Carves to advise on fuel handling and preparation problems.

Coal handling plant by

Simon-Carves Ltd SIMON ENGINEERING GROUP

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SCI61

This leaflet should be on your files...

It describes the Brush self-regulating alternators which offer you better performance at lower overall costs on these main counts:—

- ★ No automatic voltage regulator needed
- ★ Voltage regulation 2½ per cent for all conditions of loading, temperature and power factor
- ★ Very rapid response with change of load
- ★ Parallel operation with similar machines or conventional alternators
- ★ Heavy load surges taken with minimum transient voltage change
- ★ Control between 50 and 60 cycles over normal voltage range

Write for Publication No. 21063

BRUSH

BRUSH ELECTRICAL ENGINEERING CO. LTD • LOUGHBOROUGH, ENGLAND

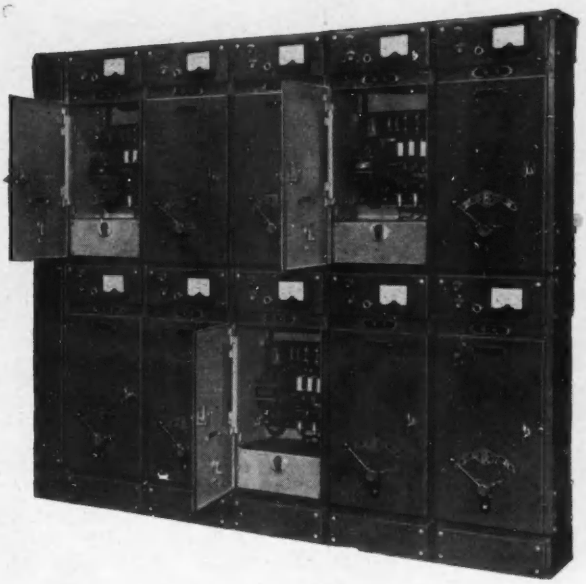
BIRMINGHAM · BRISTOL · CARDIFF · GLASGOW · IPSWICH · LEEDS · LONDON · MANCHESTER · NEWCASTLE · SHEFFIELD

B.37

From NELBEST Standard Units

build industrial CONTACTOR PANELS SWITCHBOARDS

The control gear with negligible upkeep.



Any single- or multi-tier arrangement is easily made by using Nelbest Units in their Standardised Cases. Single- or multi-purpose panels (such as contactor starters with circuit breaker and fuse distribution units) embody all the operating features of up-to-date practice. Separator boxes ease wiring and carry extra instruments. Every part is fully accessible from front or rear, and extensions are easily added.

Full details on application to :

W. & H. NELSON LTD.

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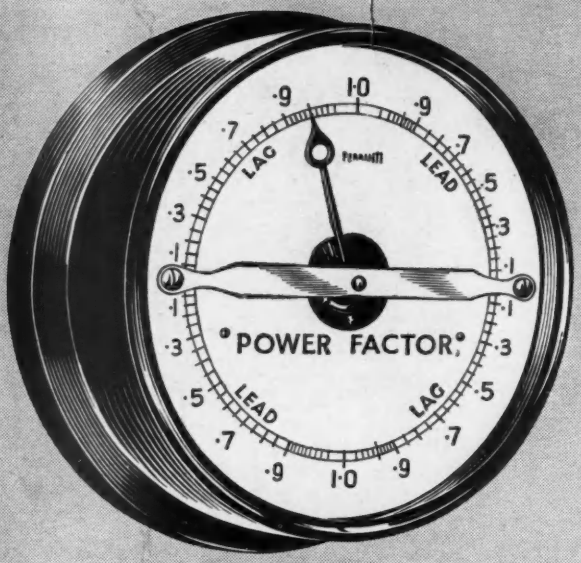
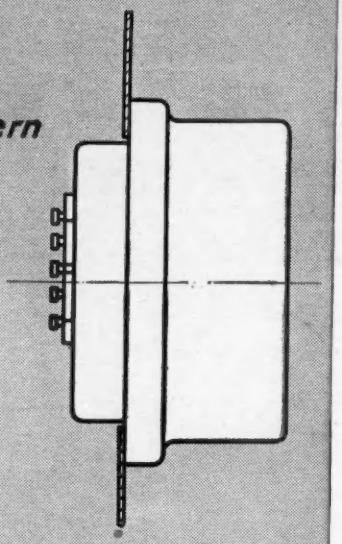
Specialists in flameproof and industrial electric control gear

POWER FACTOR METERS

NEW DESIGN · COMPACT
GOOD DELIVERY



Round Pattern



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This is one of the new Ferranti Power Factor Meters. Shallow pressed steel case. Balanced or unbalanced load. Small V.A. burden. 4″, 6″ or 8″ round or square dial, semi-projecting or flush mounting. Other recently designed Ferranti switchboard instruments with features similar to the above include ammeters, voltmeters, wattmeters and frequency meters. All types are also available in hermetically sealed cases.

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FERRANTI *Switchboard Instruments*

FERRANTI LTD · HOLLINWOOD · LANCS · ENGLAND

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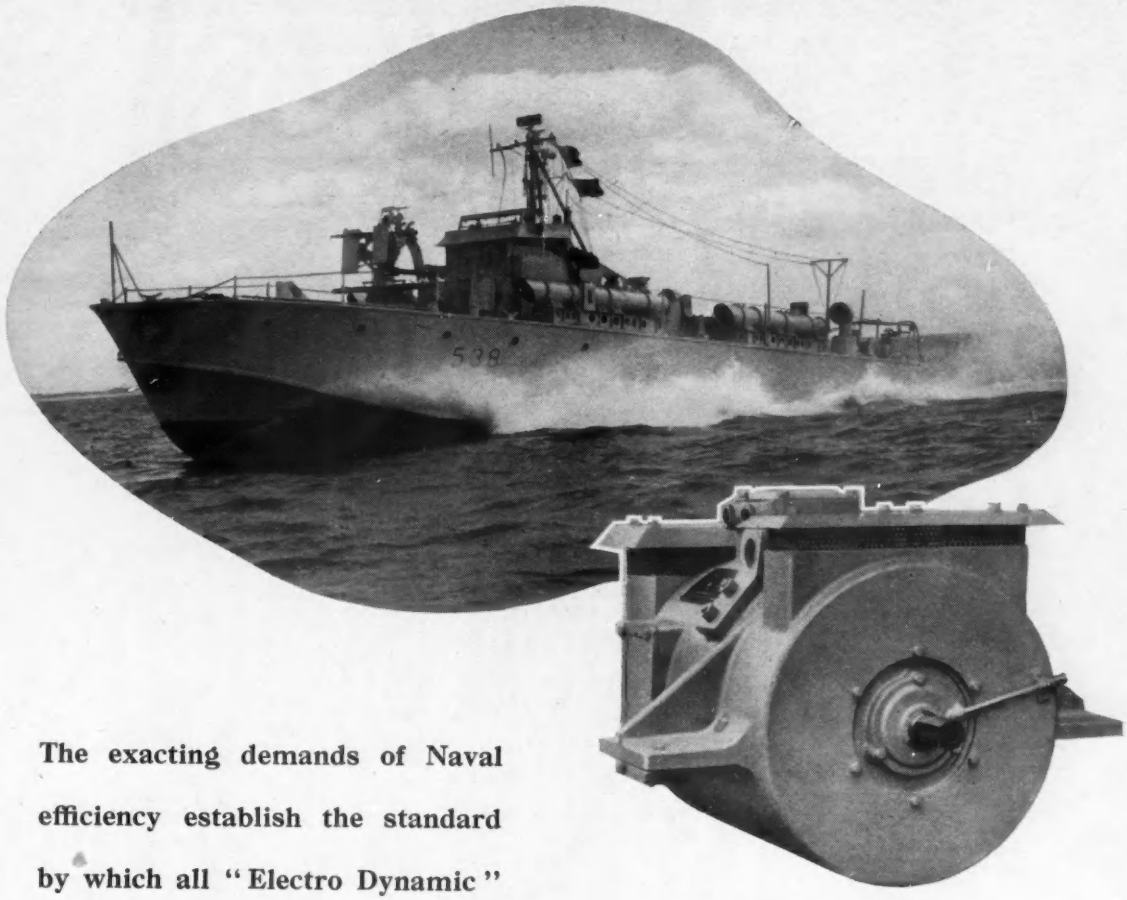

The exacting demands of Naval efficiency establish the standard by which all "Electro Dynamic" equipment is tested and judged. Therefore, in the Industrial no less than the Marine field, the reputation of Electro Dynamic Construction Company Limited stands high.

Light weight Marine Generator, 35 kW. 1,850 r.p.m., 220 volts. Drip-proof Enclosed Ventilated. 680 lb. weight.

Amongst the "Electro Dynamic" range are:

D.C. Motors up to 120 H.P.

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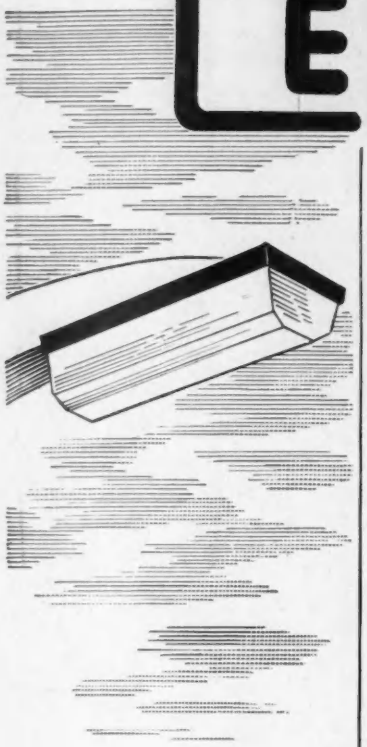

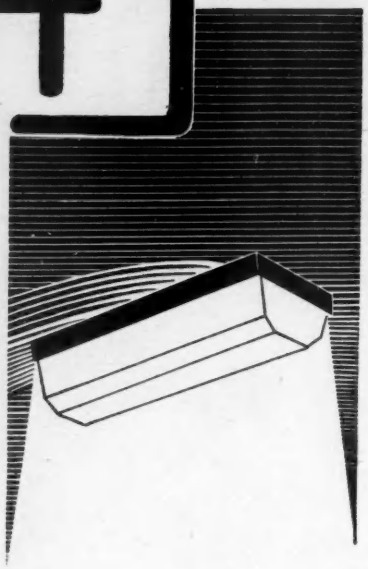

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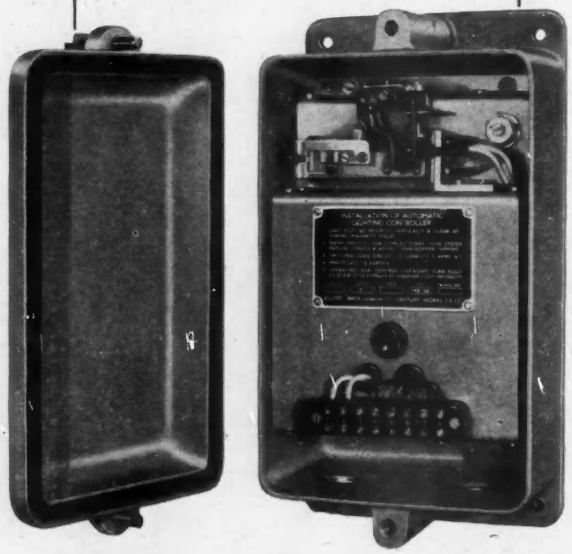
No moving parts
No valves
No resetting.

- Elliott magnetic amplifier eliminates thermionic valves.
- Exceptionally long life with minimum maintenance.
- Positive operation at specific light levels.
- Photo-electric control eliminates resetting.



Switches lighting circuits automatically on and off according to daylight intensity. Robust, reliable and easily installed on most existing circuits.

The most advanced Automatic Lighting Control System for Highways, Islands and Crossings, Factories, Airports, Harbours, Docks and Marshalling Yards.

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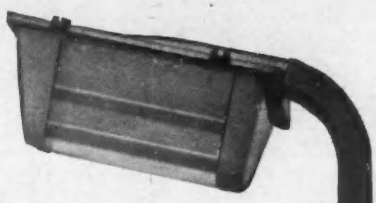
ELLIOTT BROTHERS (LONDON) LTD., CENTURY WORKS, LEWISHAM, S.E.13. Phone: TIDEWAY 3232

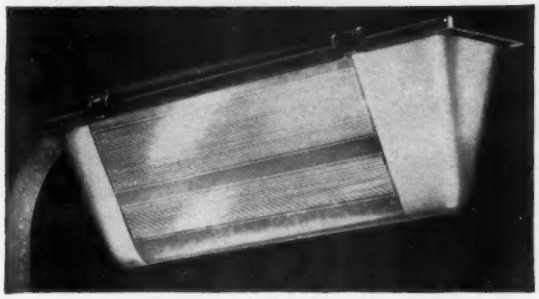


NEW 'PERSPEX'

STREET LIGHTING LANTERN

FOR CRAWLEY NEW TOWN

The new street lighting lantern manufactured and installed by The Edison Swan Electric Co. Ltd. in the new town at Crawley has a clear 'Perspex' bowl with Opal 'Perspex' ends. The light distribution is controlled by two machine-cut 'Perspex' refractor plates sealed to the inside of the bowl on either side of the lantern.



'Perspex' was chosen for ease of shaping; for the clarity of the clear sheet, and the reflection and diffusion factor of the opal; and for its outstanding resistance to external weathering.

'Perspex' is the registered trade-mark for the acrylic sheet manufactured by I.C.I.

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED
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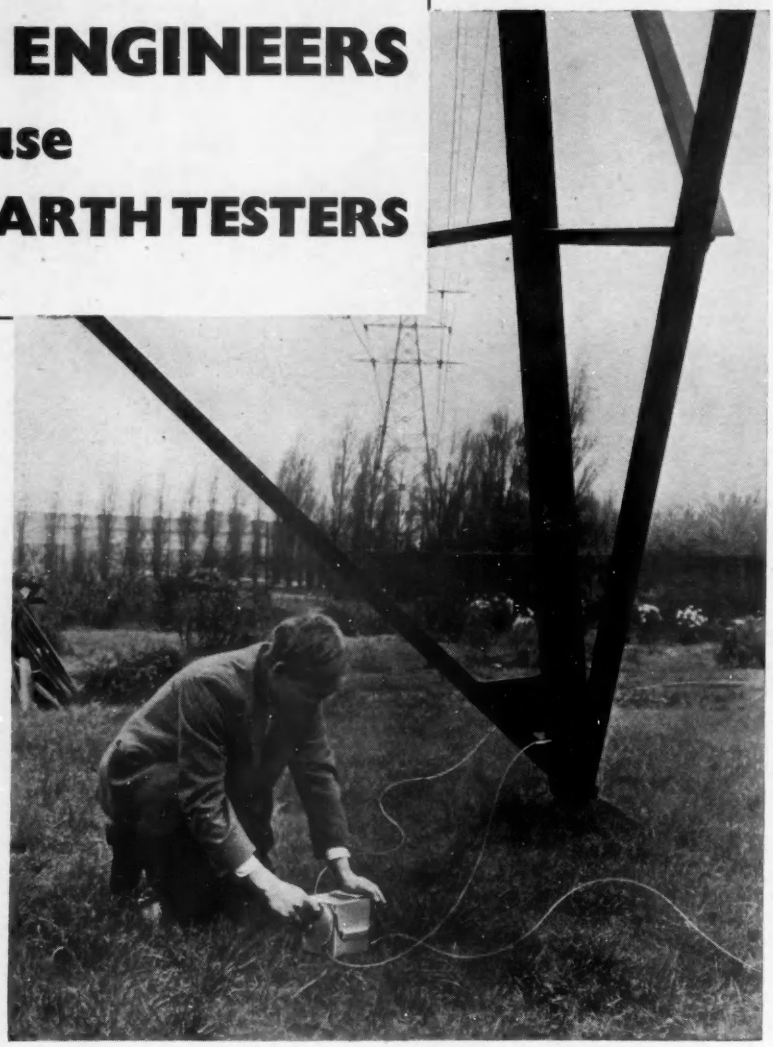
P.577

B.E.A.
LONDON ENGINEERS
use
"MEGGER" EARTH TESTERS



A B.E.A. engineer using a "Megger" Earth Tester, Series 2, to test the earthing efficiency of a pylon.

Engineers of the London Division of the British Electricity Authority use "Megger" Earth Testers to test the efficiency of earthing on recently erected metal pylons. This is only one of the many uses to which they, and engineers and electricians everywhere, put this famous earth tester. For instance, periodical tests are made to ensure that the initial low resistance of the pylon to earth is maintained.

Another use to which the Authority puts the "Megger" Earth Tester is for testing soil resistivity, as a guide to the location of new earth electrodes. In rural areas it is often employed for tests on pole transformers.

Evershed's have issued a handbook on earth testing which is an invaluable guide to the functions and versatility of the "Megger" Earth Tester. The handbook contains full details of how to make earth tests similar to those above, on your own apparatus. Ask for Publication J.247.

MEGGER TRADE MARK

EVERSHED AND VIGNOLES LIMITED

ACTON LANE WORKS - CHISWICK - LONDON - W.4

Telephone: Chiswick 3670 . Cables: Megger, London . Telegrams: Megger, Chisk, London

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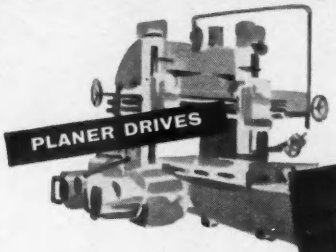
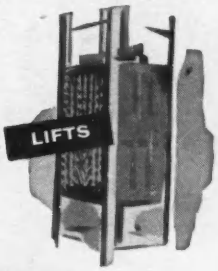
If there's a MOTOR in it...





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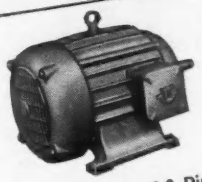
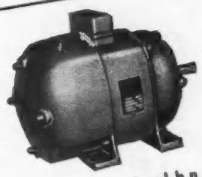
THE SYMBOL OF POWER FOR OVER 50 YEARS

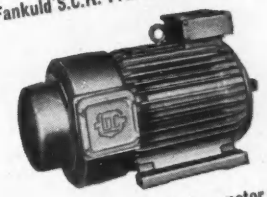


'Fankuld' 10 h.p. motor to B.S. Dimensions

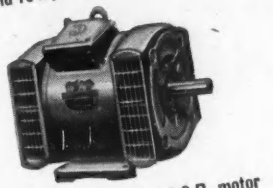
'Fankuld' S.C.R. 20 h.p. motor



'Fankuld' S.C.R. Fractional h.p. motor



'Fankuld' Slip Ring 20 h.p. motor



30 h.p. Screen Protected S.C.R. motor

Slip Ring 65 h.p. Screen Protected motor

'Tandem' Lift motor

D.C. Gasworks 20 h.p. motor

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A/I

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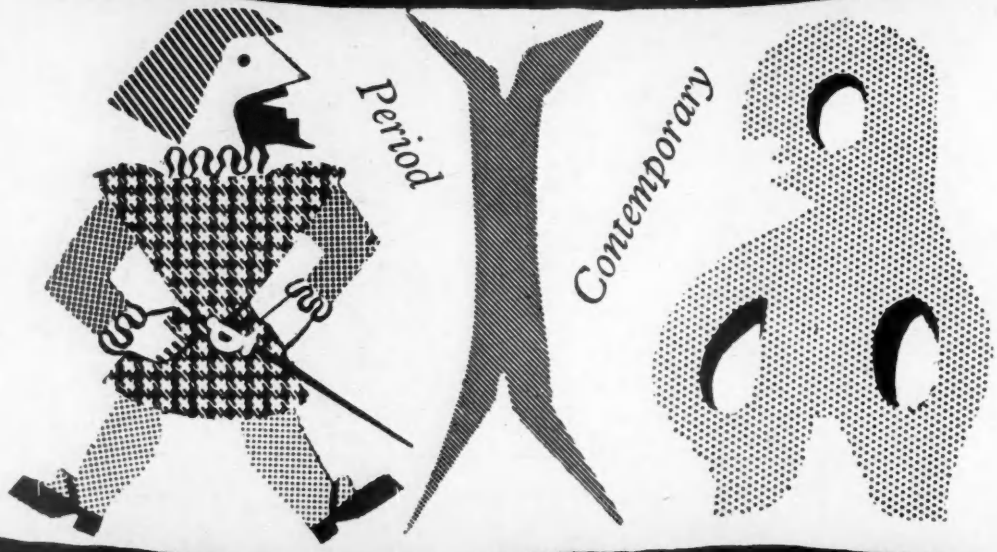

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We will serve *your* customers on your behalf

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TRANSFORMERS WITH A TOTAL CAPACITY OF

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FOR INSTALLATION AT THE

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Two	63,000 kVA Transformers 11.8 132 kV, Water cooled, with on-load tap changers.
One	72,000 kVA Transformer 11.8/132 kV, Water cooled, with on-load tap changer.
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NEW ELECO "PERSPEX" FITTING FOR INDUSTRIAL CONDUIT LIGHTING

—Increases Light Output Ratio 10-15%

This new Eleco fitting (patent applied for) is efficient, versatile and economical. It can be used either open, or made completely dustproof with a diffusor cover. The reflectors are made in two grades of opal 'Perspex', whilst the covers are obtainable in three grades, including a pinspot pattern "Perspex". This means that a suitable combination can be arranged to control the percentage of upward light and brightness over a considerable area. Thus, units can be selected to give the best lighting effect for your particular installation.

TOTAL THESE FEATURES - AND YOU GET TODAY'S MOST EFFICIENT LIGHTING

For 100 to 500 watt tungsten Lamps, 80-125 watt MB/V Mercury.

Lighting output Ratio exceeds 85%. Balanced distribution — 10-25% upward light.

High mechanical strength — Resists corrosion.

Low initial cost.

Ease of installation.

White stove enamelled interior.

For further particulars or help on any lighting problem write to:

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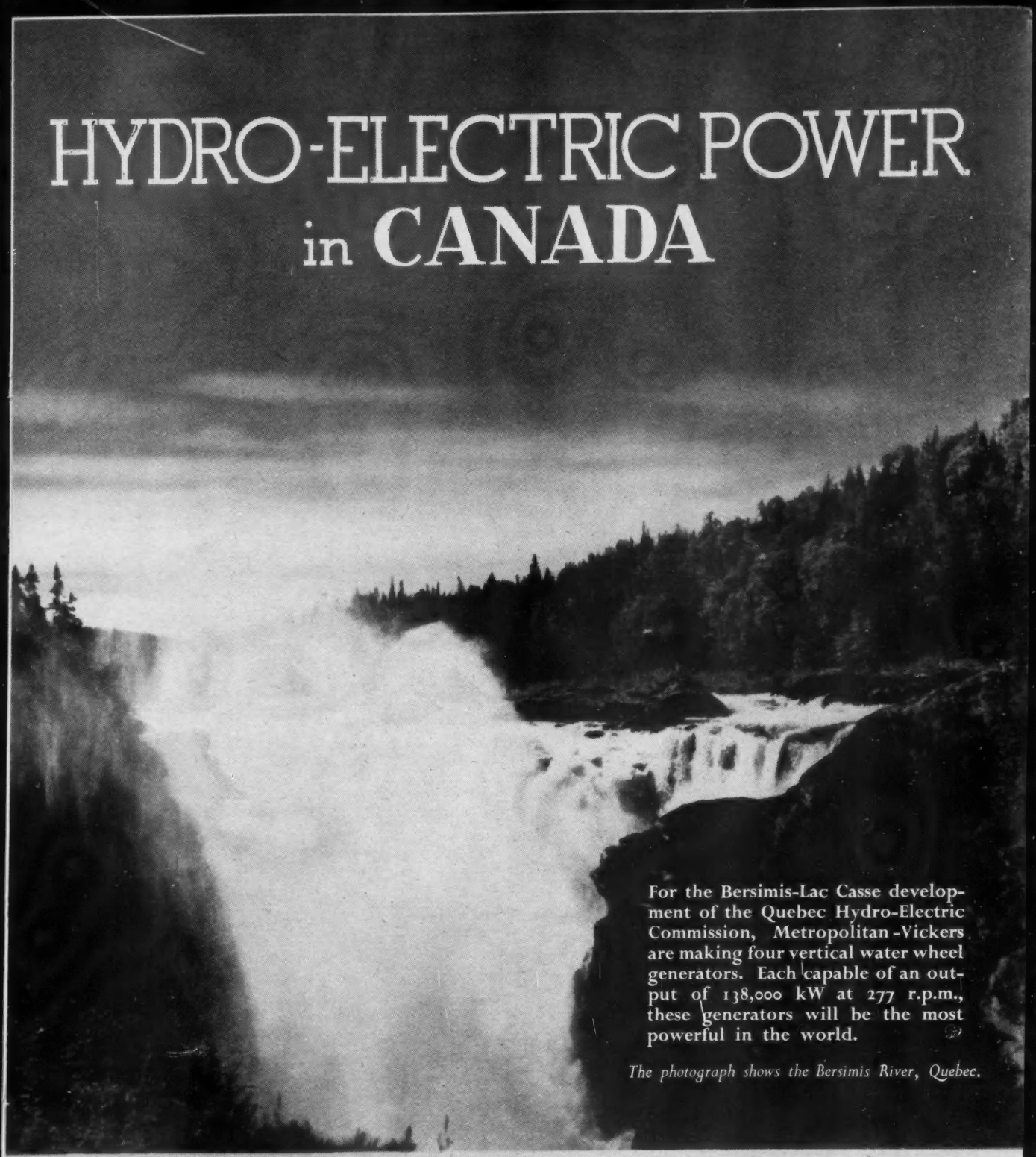
HYDRO-ELECTRIC POWER in CANADA



For the Bersimis-Lac Casse development of the Quebec Hydro-Electric Commission, Metropolitan-Vickers are making four vertical water wheel generators. Each capable of an output of 138,000 kW at 277 r.p.m., these generators will be the most powerful in the world.

The photograph shows the Bersimis River, Quebec.

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CIRCUIT BREAKER TYPE S121

only 1½" wide x 4⅜" high

For power and lighting circuits up to 30 amps 250 volts. Instantaneous short-circuit, thermal time-lag overload releases, and neutral link available. High rupturing capacity.

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Smee's S.73

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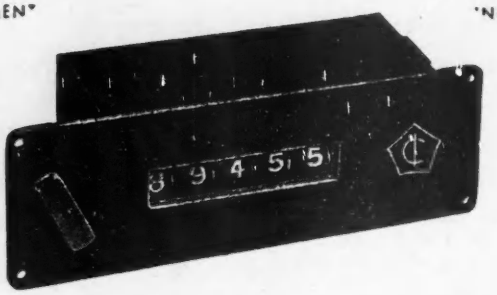

Illustrated is our Flush Mounting Electro-Magnetic Counter with five figures. Details of this and other models are given in our leaflet EM.

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British European Airways Photograph

at the B E A Engineering Base, LONDON AIRPORT

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The four substations feeding the base are equipped with J. & P. Transformers and Switchgear (h.v. & l.v.), and for the main power supplies, J. & P. Aluminium Sheathed Power Cables have been used exclusively.

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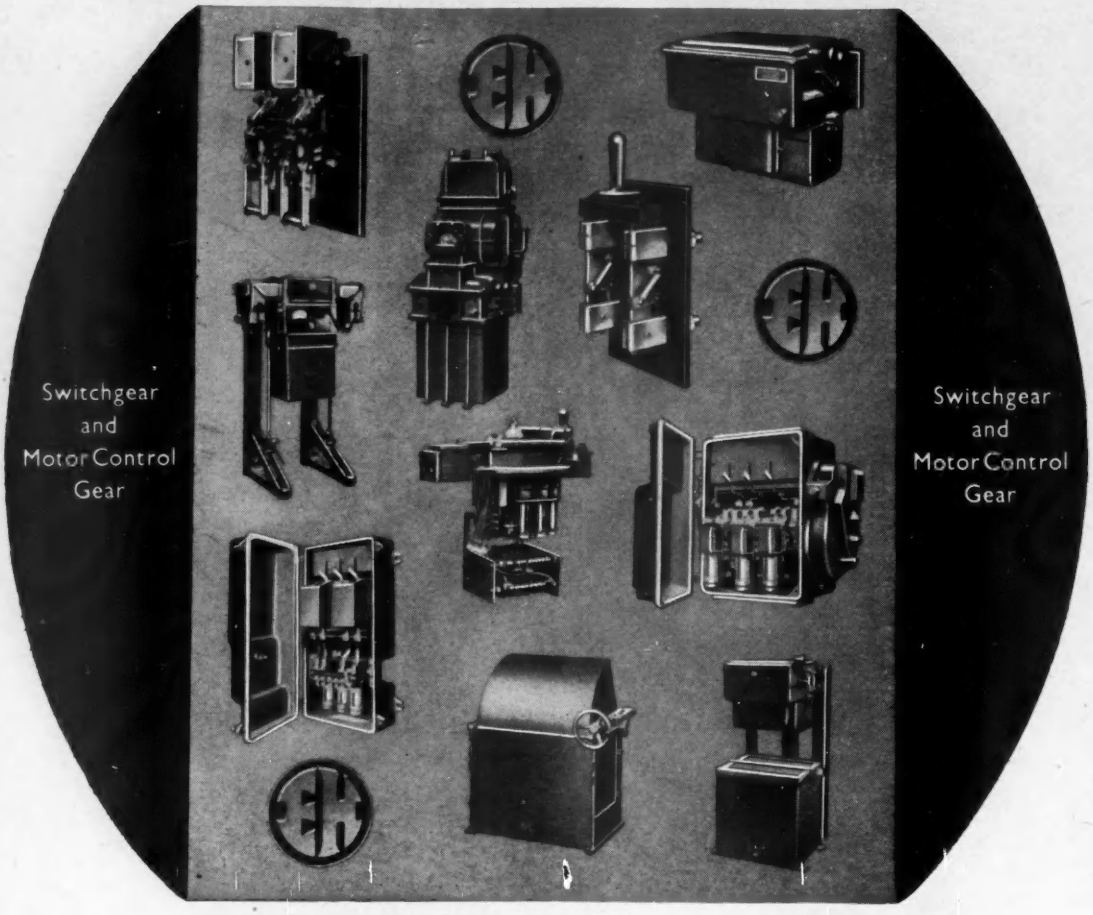
SPECIALISTS IN THE MANUFACTURE OF SWITCHGEAR SINCE 1905



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L.T. SWITCHGEAR *50/5000 AMPERES*
E.H.T SWITCHGEAR *up to 11 kV 250 MVA rupturing capacity*
MOTOR CONTROL GEAR *¼/5000 H.P.*

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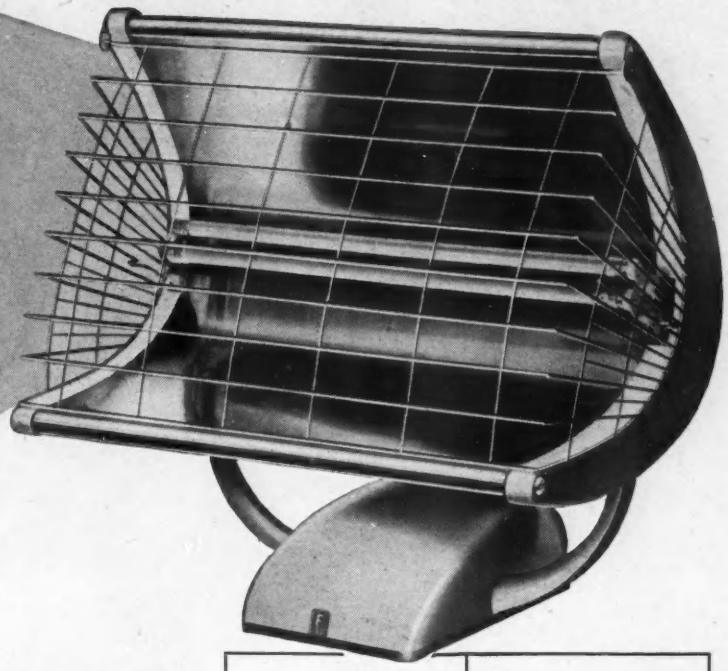
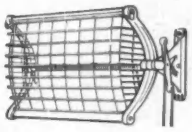


Once again the public is looking to electricity for clean, easy and reliable heating. And that is exactly what Ferranti is offering – in striking advertisements which will appear all winter in National papers and magazines.

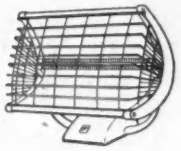
This year's range of Ferranti Radiant Electric Fires combines a new level of design with an efficient and economic performance. Be sure they will catch the public eye – in *your* showroom. We have ample stocks of all models to meet the coming demand.

Model F.3111
1250/2500 watts
£14.17.0 (Tax Paid)

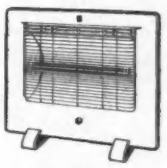
Model F.3117
1250/2500 watts
£16.14.7 (Tax Paid)



Model W.2781
1000 watts
£5.7.10 (Tax Paid)



Model F.3108
1000/2000 or
1250/2500 watts
£11.9.5 (Tax Paid)



Model F.3123
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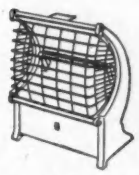

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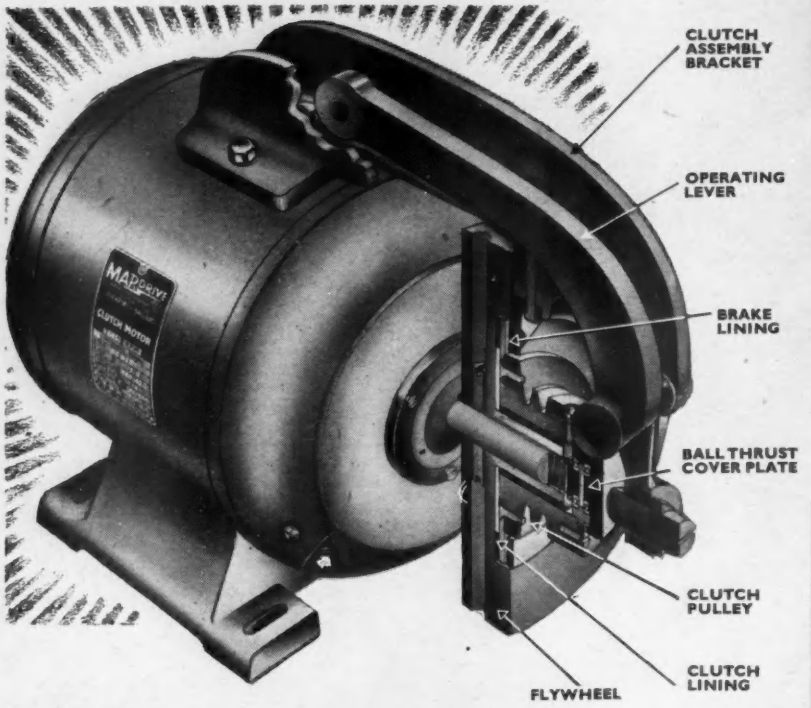

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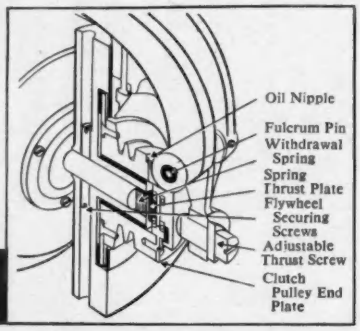

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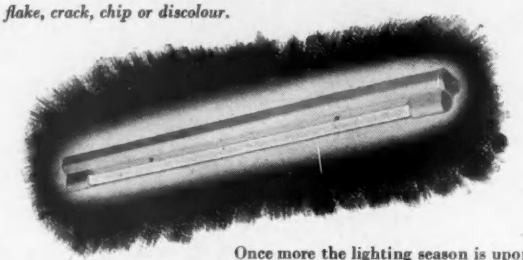

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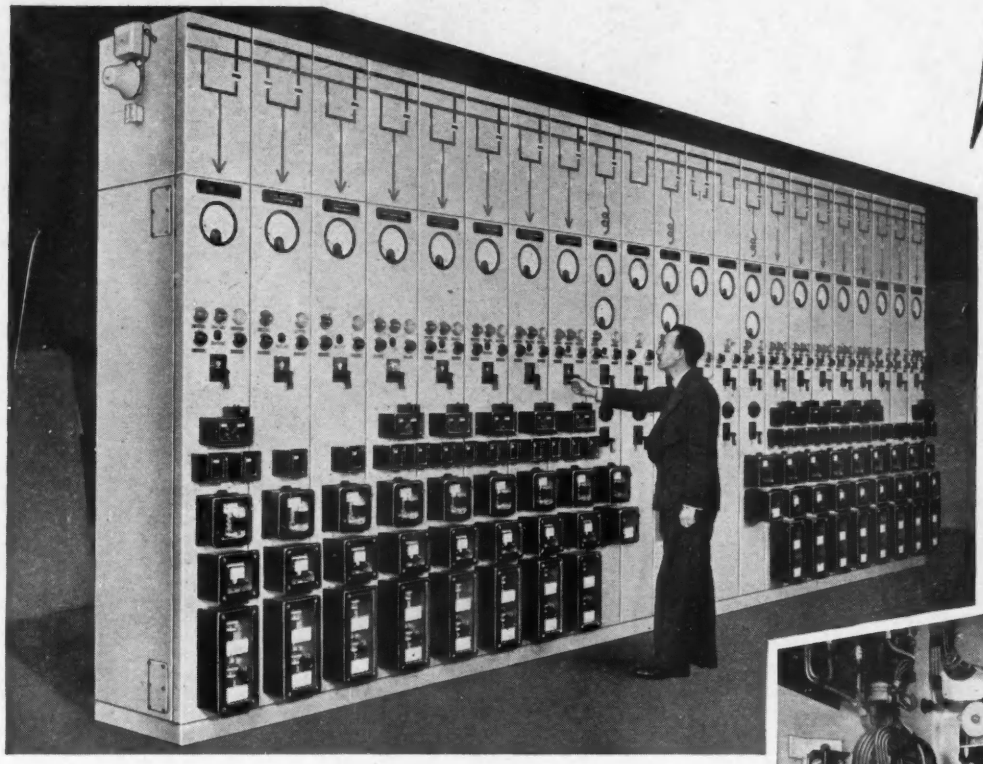

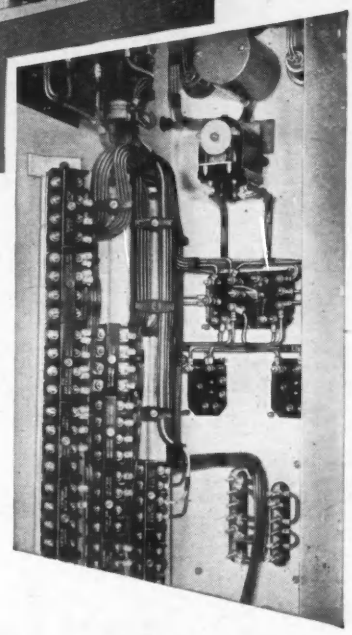

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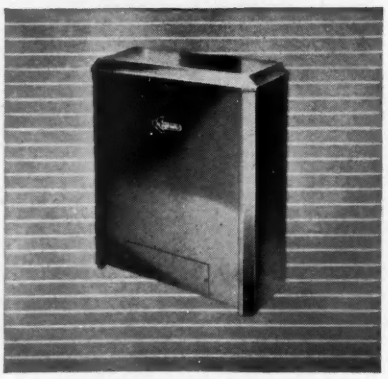

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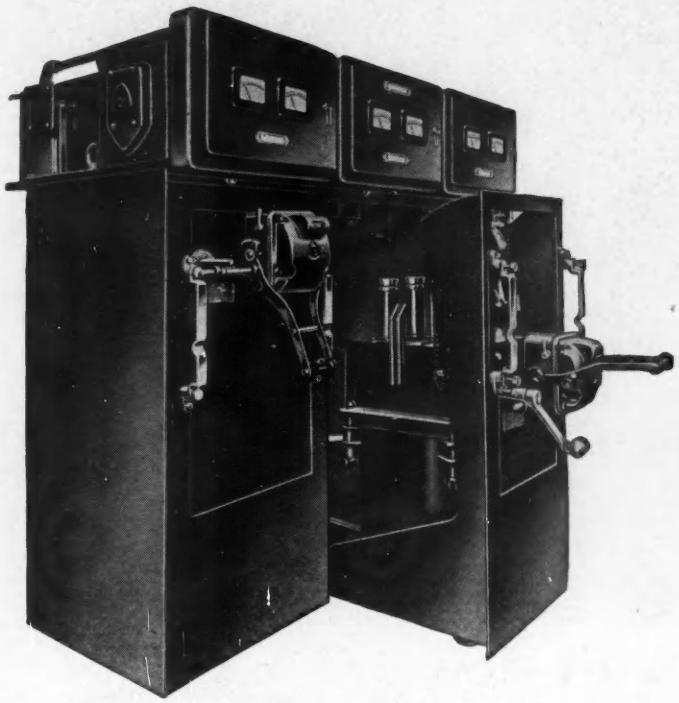

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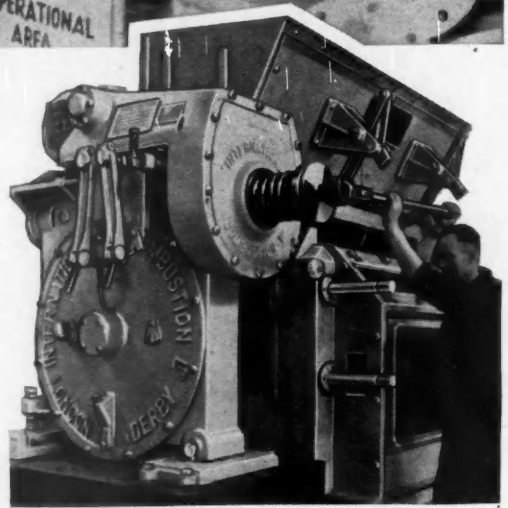

Top: A large 'L' type stoker with twin travelling grate during installation.

Below: Hand operation of small 'L' stoker grate during erection.

C13

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SCOTLAND ON SHOW

It must be made in Scotland, has been the criterion of admissibility for exhibits at the second post-war Scottish Industries Exhibition, which Her Majesty Queen Elizabeth, the Queen Mother opens in Glasgow today. Yet that has placed few limits on the exhibition's coverage of the whole range of engineering activity. There are few things that Scotland cannot claim to make, while trade statistics show that in some branches of manufacture, Scotland, with one-tenth of the United Kingdom population, is producing over half her output. It is surely appropriate that, having shown herself a world-accepted centre of culture in the Edinburgh Festival, Scotland should so soon assert her complementary importance in terms of industrial power. As the catalogue of the exhibition shows, it is not only in her traditional products that she is playing a notable part. In the young industry of electronic engineering, Scotland is becoming an important centre of this island's effort. Co-operative research on a local rather than an industry wide basis is playing an important part in this progress, signalling a willingness to experiment in methods as well as materials. Indeed, Scotland is active in the whole field of industrial research. In all respects, there is a full and lively service behind the exhibits in the Kelvin Hall. Scottish industry means to deserve success.

SEMI-CONDUCTOR VERSATILITY

It has been stated that the evolution of new semi-conductor materials is the most important single development in recent electrical technology and certainly from the concentrated research on this subject being carried out in this country—an example of which is described on pages 323 and 324 in this issue—and also abroad, the statement carries a fair amount of truth. Hitherto, most attention has been called to the use of germanium semi-conductors in the radio and telecommunication fields where their application in transistors, and other devices permits full advantage to be taken of the inherent robustness, small size, and reliability. But over the past few years, developments of great significance to the power industry have been taking place, particularly in the case of rectifiers. The germanium power rectifier has already passed out of the laboratory in its smaller sizes and has been experimentally built for a capacity of 300 kW with an output of 1,100 amps at an efficiency of about 98·5%. But this only represents the initial vista of an ever-widening prospect. Already new materials are under investigation including one—copper indium selenide—which has point contact rectification with

peak inverse voltages of the order of 400 V. At the same time certain physical/electrical phenomena, among them the Peltier and the photo-electric effect, found only in small magnitude in normal materials, exist in a much greater degree in other semi-conductor compounds. Fundamental research into these substances is now being undertaken at considerable expense, but only occasionally does a discovery arise with such wide-spread potentialities, and certainly the money in this case will be well spent.

BEST OF BOTH WORLDS

For electricity supply undertakings, selling a domestic appliance to a consumer is the key to an indefinite future of custom. Profit on the sale itself is reinforced by the expected energy consumption and by the contribution each appliance makes to the economics of diversity. Naturally enough, the private trader seldom sees the question in this light, and he finds particularly unfair the more favourable terms that supply authorities feel justified in offering potential customers where hire purchase is in question. The resulting bitterness does little good to the industry as a whole, and is quite out of place today, when the need is for better co-operation between all sections of the industry so that electrical progress may be quickened. There is a lesson on compromise in this respect in an agreement now operating in Eire between the Electricity Supply Board and the Society of Irish Electrical Traders. Where an approved private trader makes a hire-purchase sale of certain appliances, the financing of the deal and the collection of the instalments is left to the Supply Board on the same terms as for a showroom sale. Thus the industry as a whole benefits from the relatively low interest rates and the sanctions on non-payment which are possible for the supply authority; and it gains as well from the skill, initiative and reputation of locally known private retailers. The scheme reads as an admirable essay in co-operation, meeting a difficult problem with a solution whose progress it is worth watching.

BUILDING WITH FLY ASH

The story of science abounds in examples of seemingly useless by-products transformed into desirable raw materials for some newly developed industrial process. So far, however, no such discovery has favoured the fly ash which is produced in pulverised fuel fired boiler plants. This has remained an increasingly expensive nuisance. Experiments have been made over the past few years in its use in building materials—it is not so long ago that Leicester Power Station was added to in the form of building blocks made from its own fly ash—but such experiments have held relatively little hope of a wide-spread solution to the problem. It now appears that a concentrated attack by scientists of the B.E.A. and of the D.S.I.R. Building Research Station may have produced a solution on the necessary large scale, though it is still the field of building materials that is involved. The simple house brick, according to a recent statement, may be none the worse for a high proportion of fly ash, and the large demand for bricks makes potentially practicable the absorption of a sizeable proportion of the two million tons and more of fly ash collected every year in power stations. Two difficulties remain. Firstly, for economical working, it would be necessary to site brickworks using fly ash near the supplying station, perhaps even in its grounds; and this seems likely to introduce some awkward problems of control. It is improbable that the B.E.A. will want to add a few dozen brickworks to its existing responsibilities! The second difficulty is more fundamental. The building trade has yet to be convinced that fly ash bricks are as good as the scientists say. To persuade it will be a long job, but it is one which the B.E.A. may well find worthy of energetic attention.

QUALITY FOR COMPOUNDS

A box compound should be easy to pour and afterwards demand no care or attention. Many engineers would leave the matter there, and they will be surprised to read, in an article we publish this week, of the amount of research and testing that goes into every reliable compound before it is marketed. Experience has emphasised how vital is the role that such compounds play, and an impressive level of standardisation has been built up on an international scale. Behind the trouble-free service now expected is a wealth of care concerning physical and chemical characteristics as well as close attention to behaviour in the field.

CHARGING THE COST

Throughout the relatively short history of electricity supply, there has occurred a tendency to use the efficiency of electricity generation as a means of subsidising some associated undertaking. Charging "what the traffic will bear," instead of a fair economic price may have some short-term advantages, but in the long run it inevitably slows down the expansion of electricity sales, and so brings other undesirable effects in train. This takes on a particular importance when the aim is the general development of some "backward" area—as is often the case today. Yet in the report of a Conference organised earlier this year by the Asia and Far East section of the United Nations, this suggestion that more than the fair price can be safely charged for electricity is again advanced. Technical aspects of the development of water resources was the subject of the conference, and amongst the topics discussed was the allocation of costs in a multi-purpose project. A ceiling on charges for irrigation should, it is recommended, be established by the ability of farmers to repay. Revenue from sales of electrical energy, on the other hand, is required not only to make a full contribution to the corresponding costs; it is considered that it should also contribute in many cases towards the cost of flood control, irrigation and other purposes. No doubt this is a convenient initial approach, but to recommend it generally is dangerously inimical to the successful long term development of an area. Cheap electricity, more than most benefits, can hasten improvements in industrial and agricultural output and in social standards.

Meteor

Filling Compounds *for Power Cable Accessories*

THEIR SPECIFICATION, CHARACTERISTICS AND APPLICATIONS—PART I

By A. KING

COMPOUNDS for power cable accessories, which are more conveniently and commonly, but less precisely, known as box compounds, have vital roles in cable systems. Increasing realisation of their importance has led to their receiving consideration on an international scale, and they are subjects of national specifications in many countries.

In Great Britain the British Electrical and Allied Industries Research Association (E.R.A.) has played a prominent part,[1] and in collaboration with the Cable Makers' Association and other manufacturers and users of filling compounds, assisted materially in the drafting of B.S.803:1938 "Solid Bituminous Filling Compounds for Cable Boxes on systems up to and including 11,000 V." After about 10 years' further experience, the British Standards Institution undertook revision of this specification, with the co-operation of the above-mentioned bodies and others, including the British Electricity Authority and Area Boards, and B.S.1858, "Bitumen-Base Filling Compounds for Electrical Purposes" was issued in 1952. This British Standard supersedes B.S.803 and B.S.688:1936 "Bituminous Filling Compounds for Electrical Apparatus, excluding those used for cable boxes"; it is worthy of note that the foreword states ". . . the methods of test being based as far as possible on the Standard Methods of Testing Petroleum and its Products[2] issued by the Institute of Petroleum . . ."

In the international sphere the Conférence Internationale des Grands Réseaux Electriques à Haute Tension (C.I.G.R.E.—International Conference on High Voltage Systems) has taken an interest in filling compounds for some years. A study Sub-Committee was appointed before the war and its work was resumed in 1948, since when its active members have included delegates from eight European countries, and Canada. It presented a Report[3] to the 1950 session of C.I.G.R.E., dealing with bituminous compounds, and its subsequent work, reported at the 1954 session,[4] has included the study of oil/rosin compounds.

It will be seen, therefore, that there is widespread appreciation of the significance of filling compounds, even the bituminous varieties of which are required to have certain definite characteristics, and should not be regarded simply as "pitch." Fig. 1 is a view of a modern installation for the manufacture of bituminous compounds.

Mr King is with British Insulated Callender's Cables Ltd.

Classification of Compounds

This article attempts to classify filling compounds, to describe their characteristics and the methods of test to which they are submitted, and to deal briefly with choice of compound and accessory filling practice; it is intended primarily for British engineers but makes reference to overseas conditions.

Fig. 1. View of Modern Compound Shop. Large mixing vessels on left, small pots right

Most of the compounds manufactured in Great Britain fall into three main categories.

Bituminous. B.S.1858 differentiates between:

(*a*) Asphaltic (petroleum) bitumen, which is prepared from natural hydrocarbons, viz, petroleum. In practice this is not simply a residue left when crude oil is fractionated to separate its more important constituents, but is prepared from selected asphaltic crudes by specialised processes.

(*b*) Natural asphalt with which is associated inert mineral matter. Trinidad Lake asphalt is a well known bitumen of this class, having been used by cablemakers for half a century.

Coal distillation products such as coal (gas) tar and coal tar pitch are precluded from B.S.1858 compounds by implication, and their use is prohibited specifically by certain foreign specifications. This attitude is basically sound, although selected products have restricted but valuable application.

Bituminous compounds cover most requirements for voltages up to and including 11 kV, have been widely used for 20 to 25 kV, but have been adopted on a modest scale only for 33 kV for reasons which will be discussed later.

Apart from joints proper and terminations, bituminous compounds are used also for filling the outer protection boxes of joints.

Oil/Rosin. These compounds are similar to but often more viscous than the oil/rosin compounds used for impregnating paper-insulated cables. The oils are insulating quality, generally naphthenic, hydrocarbon (mineral) oils of medium viscosity, and natural gum rosin (colophony) is the preferred type of rosin, although refined rosin is more suitable for cable impregnants.

More 33 to 66 kV accessories are filled with oil/rosin compounds than any other type, and they have been employed to some extent at lower voltages, but the technical case for this is seldom strong and bituminous compounds are almost invariably cheaper.

Oil-Resisting. Two types of compound which have given satisfactory service are based respectively on natural gums and vegetable pitches, the latter normally only for voltages up to 11 kV. Oil-resisting compounds find their main applications in joints at the lower end of inclined power cable runs, in the sealing chambers of disconnecting boxes, and in low terminations for auxiliary cables.

Miscellaneous. Under this heading may be included (*a*) styrene compounds which are associated with particular designs of cable accessories,[5] (*b*) cold-pouring compounds and fire-resisting compounds such as were developed in Great Britain for certain coal mine conditions,[6] (*c*) plastic compounds, of which some are oil-resisting, for wiring system fittings, and for sealing grooved joints and the like, and finally (*d*) the highly specialised oils and compounds employed in high voltage pressure-type cables.

Characteristics and Tests

In the usual low voltage cable accessories the prime requirement of filling compounds is to prevent ingress of moisture. Hence the compounds must exhibit low permeability to and solubility in water, should adhere well to materials within the accessories, and not develop cracks under conditions such as arise from low temperatures and vibration. Electrical characteristics like electric strength, permittivity, and dielectric loss angle (tan δ—power factor), are of minor or even negligible significance at voltages below about 11 kV: for these voltages even the level of electric strength required by most accessory designs is so modest as to be met very readily by good quality bituminous compounds.

In addition to the above, there are various other characteristics of both chemical and physical nature to be taken into account.

Below are discussed the principal characteristics of interest; brief descriptions of methods of test are also given, together with references to specifications which describe them fully. The characteristics discussed are, in order: resistance to water, adhesiveness, brittleness, penetration, softening point, pouring temperature, electric strength, contraction and depth of pipe, flash-point, mineral ash, segregation, carbon disulphide solubility, injurious sulphur, acidity, density, and the effect of heating. Fig. 2 is a composite photograph of several items of apparatus, and later illustrations show certain individual items.

Bitumens of the types in question have such low permeability to and solubility in water that tests for water resistance are becoming increasingly rare in specifications for bituminous filling compounds: pure bitumen dissolves less than about 0·01% water, and its permeability is of the same order as that of rubber. Certain mineral fillers, both natural and added, decrease this water resistance, but generally not significantly in the present context.

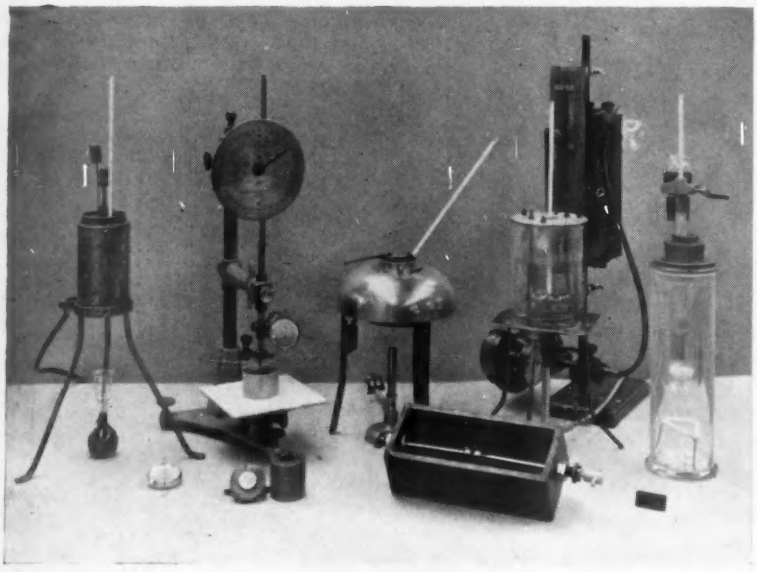

Fig. 2. Assembly of compound testing apparatus. Rear (L to R): Pouring temperature, penetration, flash-point (open), softening point, Fraass breaking point (steel plaque at foot). Front (L to R): adhesiveness, electric strength cell

Adhesiveness, Brittleness and Penetration

The adhesiveness of bitumens to metals, e.g., iron, steel, lead, aluminium and copper, and to cable insulating materials is good, especially if they are dry and clean. Bitumens of low softening points almost invariably adhere more readily than the harder ones, which need to be heated to higher temperatures to ensure their good adhesion to metals; all metal accessories should be

warmed when practicable, to obtain the best results. It is extremely difficult to get bitumen to adhere satisfactorily to certain surfaces, such as glazed earthenware.

In the B.S.1858 (Clause 14 and Appendix L) method of test a pre-heated cylindrical steel mould with a detachable base plate is filled with hot compound, and then allowed to cool; the requirement is that when the base plate is detached its inner surface shall be coated with compound over not less than 90% of its area.

This is a sound test but compliance with it does not ensure that a compound will continue to adhere effectively to a metal box in service: a compound can give 100% coverage and yet be so brittle as to break away later from the box, leaving only a surface film.

The Belgian method[3] is typical of tests which consist essentially in pouring a layer of compound on to a flexible sheet of metal, cooling and then bending it to observe the resultant adherence.

B.S.1858 does not yet include a specific test for brittleness because there exists no widely acceptable method, although several apparatus and procedures are used in different countries and considerable research has been done and continues on the subject, the importance of which is realised.

Perhaps the most informative guide to brittleness is the Fraass breaking point, in conjunction with other data, e.g., penetration and softening point. The apparatus and method are described in the I.P. Standard Methods of Testing Petroleum and its Products, under designation I.P.-80/53, from which Fig. 3 is taken. Briefly, a steel plaque coated on one surface with a film of compound is cooled progressively and bent periodically until the film breaks, and the temperature at which this occurs is called the Fraass breaking point. This is an empirical method of test and it must not be assumed that a compound does not become brittle until it is cooled to this temperature: the method does not subject the compound to stresses such as arise from severe vibration, for example.

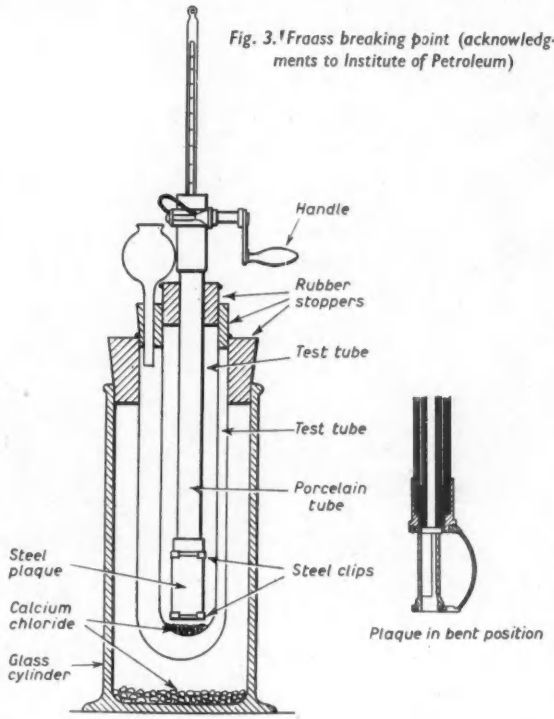

Fig. 3. Fraass breaking point (acknowledgments to Institute of Petroleum)

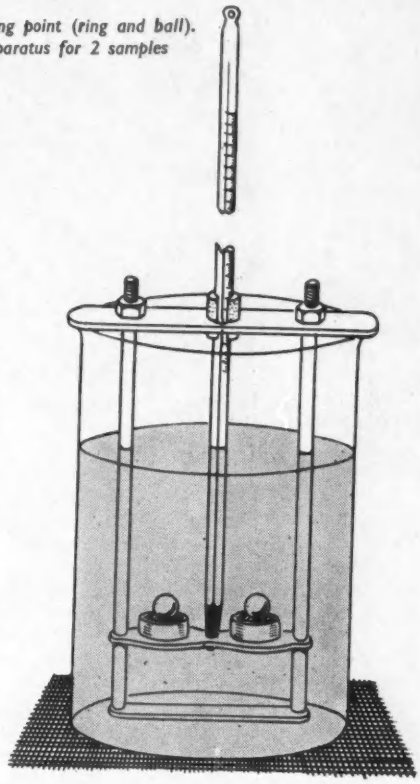

Fig. 4. Softening point (ring and ball). sketch of apparatus for 2 samples

Softening Point and Pouring Temperature

The penetration of bituminous and similar substances is the most valuable single measure of consistency, and is determined by a universally standardised method (B.S.1858, Clause 6 and Appendix C). It may be defined as the depth in 1/10 mm which a standard needle under a load of 100 grams penetrates through the surface of the sample in a period of 5 seconds. The usual test temperature is 25° C, but it is sometimes advantageous to have values over a range including lower temperatures. This apparently empirical method is soundly based technically and the results are related closely to viscosity.

Bitumens do not exhibit melting points; on heating in the temperature range concerned they become progressively softer, or more fluid, i.e., less viscous—there is no temperature at which they change suddenly from solids to liquids, as many metals and waxes do.

In Great Britain and many other countries the ring and ball method of test (B.S.1858, Clause 5 and Appendix B) has become standard (Fig. 4). The temperature is raised at a rate of 5° C per minute until the compound softens sufficiently for the ball to drop to the base plate, and the temperature at which this occurs is called the softening point. As in the case of penetration, the ring and ball softening point method is better designed technically than might appear: at softening point temperatures asphaltic bitumens have a similar viscosity of about 12,000 stokes.

B.S.1858 (Clause 8 and Appendix E) leaves room for doubt as to the meaning of the term "pouring temperature," but here the definition of Appendix E is accepted, viz, the pouring temperature is the temperature at which 50 ml of compound flow out of the standard apparatus in 25 seconds; it is the temperature at which the compound has a viscosity of approximately 1,000 centistokes.

Thus the method gives a temperature at which the com-

pound has a given viscosity, but there is no general acceptance of that viscosity as appropriate to all compounds and accessories. Opinions differ, and hence the requirement of Clause 8 for agreement between purchaser and supplier as to the temperature at which compound should be poured; some suppliers express this conveniently as the recommended pouring range. In any case, it is clearly desirable to pour at the lowest possible temperature in order to minimise contraction on cooling.

The B.S. 1858 apparatus is similar in design principle to the Redwood viscometer, in that the compound is contained in a controlled temperature cylinder having an orifice of standard dimensions through which the compound flows into a measuring vessel.

Electric strength

The a.c. strength of good quality bituminous compounds is high in relation to accessory requirements, and the B.S.1858 proof test may be taken as a control of the quality to be expected of certain materials, rather than as a measure of the electric strength needed in service.

The B.S.1858 (Clause 9 and Appendix F) test stipulates that compounds shall withstand without breakdown 15 or 20 kV r.m.s. 25-100 c/s at a temperature of 60 or 90° C, according to the class of compound, using 0·5 in. diameter spheres with a gap of 0·05 in. Tests of this type do not always give consistent results, even with good equipment and experienced personnel, a fact acknowledged in the British Standard which accepts compliance by two out of three tests. It is sometimes of interest to continue the test to breakdown, for which purpose the voltage may conveniently be raised in increments of 1 kV per 5 seconds; the breakdown value is influenced little in general by the prior proof test.

Fig. 5 shows the electric strength/temperature relationship of two bituminous compounds A and B. Compound A is of natural asphalt base and contains considerable mineral matter, and was submitted to 15 kV for one minute at each test temperature before being taken to breakdown, while compound B of asphaltic bitumen with a low ash content withstood 20 kV for one minute in a similar series of tests. In illustration of earlier remarks about the significance of electric strength it may be noted that compound A with the lower values has a good service record of several decades, on a large scale at voltages of about 22 kV and to a limited extent at 33 kV, whereas compound B is not normally recommended, for other reasons of course, for voltages above 11 kV.

Contraction and Depth of Pipe

The volume contraction of bituminous compounds on cooling after pouring into accessories should be as low as possible, and associated with minimum tendency to piping, so that void formation hazards are reduced as far as is practicable. Even with the best choice of compound more voids occur than is generally realised, but good accessory design reduces the hazard of their being located in vital regions. The B.S.1858 (Clause 15 and Appendix M) provisions are realistic and merit careful study; the quoted approximate coefficients of cubical expansion of 0·00065 and 0·00055 per degree centigrade for asphaltic (petroleum) and natural asphaltic bitumen base compounds respectively are noteworthy.

In the method described a glass tube of standard dimensions is filled with compound at 150°C and after cooling under controlled conditions to 20°C the volume contraction down the tube and the depth of pipe so formed are measured; to ascertain whether the compound is free from internal cavities the tube must be broken, but experience will indicate how often this is necessary in routine testing. The contraction is expressed as a percentage of the original compound volume, and a further calculation, based on linear proportionality, gives usefully the value for the compound when cooled from the maximum temperature of the recommended pouring range to 20° C; this figure may differ significantly from that for the range 150 to 20°C. A similar calculation for depth of pipe is not possible, nor is it so necessary because the reproducibility of the test results is not high, and any practical importance of the effect of cooling from the two temperatures can usually be judged with sufficient accuracy. Fig. 6 is illustrative of some of the above points. The high softening point blown asphaltic bitumen compound (1) has to be poured at a very high temperature, and this results in a marked tendency to pipe, associated with a high effective contraction in volume. The much softer compounds (2) and (3) were poured at substantially lower temperatures, and have low contractions and depths of pipe, especially the Trinidad bitumen base compound (3).

Flash-Point

The flash-point (open) characteristic is of comparatively minor importance to bituminous compounds, although its determination may be justified on the grounds that (*a*) values sensibly less than 250° C indicate the presence of fluxing oils, some of which may be undesirable, (*b*) the value is a guide to compound composition, and (*c*) it often needs to be known for transport purposes.

B.S.1858 (Clause 10 and Appendix G) specifies a temperature of 200°C min., and permits the use of a range of apparatus, with a preference for the Pensky-Martens, which involve controlled heating of a sample in an open cup and electrical or gas-flame ignition; the flash-point (open) is the lowest temperature of the compound at which its evolved volatiles are ignited to give a flash on its surface.

The open cup test is made rather than the closed, and is applicable to many substances, because its conditions compare more closely with those to which bituminous compounds are submitted throughout their life, from manufacture to service; the flash-point (closed) is commonly about 20 to 30°C lower than the open test temperature for bituminous compounds. High softening point bitumens mostly have higher flash-points than the softer ones.

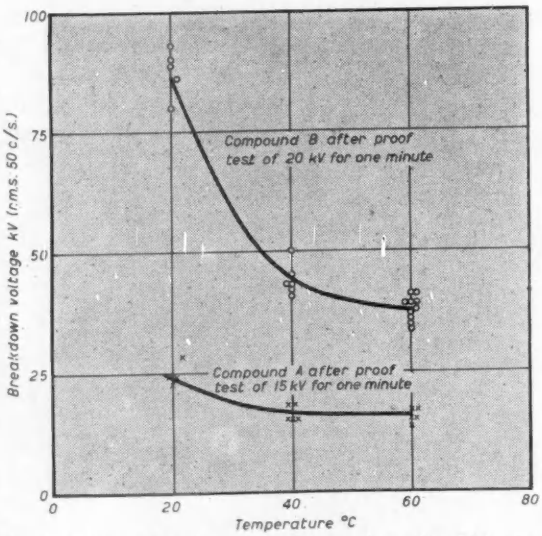

Fig. 5. Electric strength (ac)/temperature relationship of bituminous compounds. 0·5 in. dia. Spheres 0·05 in. gap. Compound A—natural asphalt base, softening point 50° C. Compound B—asphaltic bitumen base. Softening point 58° C.

Composition and Chemical Characteristics

Asphaltic (petroleum) bitumens contain only small amounts of mineral matter, while refined Trinidad Lake asphalt has about 36% by weight of intimately mixed very fine clay. B.S.1858 (Clause 11 and Appendix H) limits the ash content of the former type of compound to 0·5% max. and that of natural asphalt and artificially loaded asphalt compounds to 37%. Determination is by burning off combustible matter and weighing the residue; this treatment causes loss in weight of certain constituents of mineral matter, e.g., carbonates lose carbon dioxide, and so the ash of loaded bitumen compounds is then carbonated to give a value closer to that existing originally in the compound; this refinement in method is not normally justified for the lower contents of asphaltic (petroleum) bitumens.

The effects of mineral matter on bituminous compounds are very interesting and complex, but do not merit detailed discussion in the present context. It is worth noting, however, that the concentration of 0·5% mineral matter of certain compositions in an electric field can be most objectionable, while much greater quantities of the clay of Trinidad bitumen can be tolerated.

Bituminous compounds containing natural or added loading material are liable to segregate, to a degree

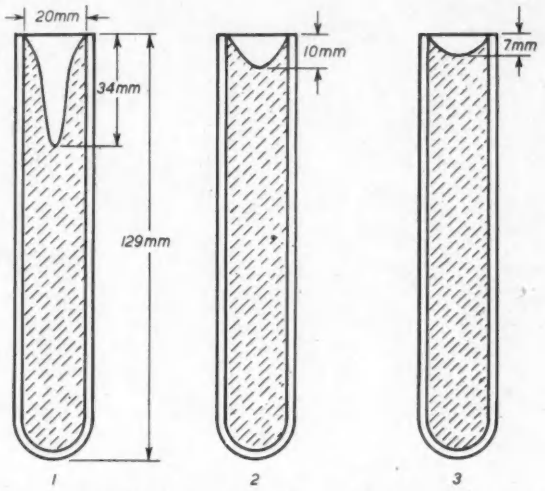

Fig. 6. Contraction forms of bituminous compounds as obtained in B.S.1858 glass tubes. The table below gives details

Type of Compound	High S.P. Blown Asphaltic Bitumen	Low S.P. Asphaltic Bitumen	Low S.P. Trinidad Bitumen Base
Softening Point °C.	115	50	50
BS.1858 Pouring Temperature °C (PT) (50 ml in 25 seconds)	200	125	120
Contraction % from P.T. to 20° C.	9·0	5·2	4·0
Contraction % 150° to 20° C. (calc)...	6·5	6·4	5·2
Depth of Pipe mm. (cooled from P.T. to 20° C.) ...	34	10	7

causing variations in their properties, both physical and electrical. This can arise through incompatibility of ingredients, faulty compound manufacture and packaging, or incorrect field practice, e.g., overheating or insufficient agitation.

B.S.1858 (Clause 16 and Appendix N) specifies a test which is conveniently associated with that for adhesiveness: carbonated ash determinations on samples taken from the top and from the bottom of the mould shall not differ by more than 0·5%.

B.S.1858 (Clause 4 and Appendix A) requires substantially ash-free compounds to be at least 99·5% and loaded compounds to be at least 60% soluble in carbon disulphide (CS_2). The relationship of these figures to those specified for mineral matter might suggest the test to be redundant, yet it is in fact supplementary. CS_2 is a selective solvent in the sense that it dissolves nearly all the bitumen and other materials which the specification is intended to permit, but has a much lower solubility for the precluded tars and pitches derived from coal. The ash content of pure asphaltic (petroleum) bitumen is almost identical with its CS_2 insolubles; this is not quite the case with Trinidad bitumen, largely because the clay it contains has such absorptive power as to prevent the removal of a small proportion of bitumen by CS_2, which could otherwise dissolve it.

The two methods described in the British Standard consist in submitting samples to the solvent action of CS_2, and weighing the insolubles.

Bitumens contain up to about 5% sulphur, but it is present almost invariably in innocuous forms. In view of occasional exceptions to this rule, and of the inclusion of active sulphur from other sources, B.S.1858 (Clause 13 and Appendix K) includes a rapid test to ensure that bituminous compounds do not cause harmful sulphur reaction on cable and accessory metals, particularly copper. A piece of polished copper foil is heated in a solution of the compound, and it shall become not more than slightly discoloured.

As with sulphur, there is little to fear from acids in bituminous compounds, although most bitumens tend to be faintly acid rather than alkaline in reaction. An upper limit of total acidity, inorganic plus organic, equivalent to 4 mg. potassium hydroxide (KOH) per gm., is imposed by B.S.1858 (Clause 12 and Appendix J). The method is a back-titration with alkali of a solution of a sample of compound in benzene, alcohol and water.

Density and Effects of heating

Asphaltic (petroleum) bitumens generally have densities at 20° C of about 1·0 to 1·05 (g/cc), or even up to 1·1, the lower values applying to the softer grades. Trinidad bitumen of the refined type commonly used has a density at 20° C of the order of 1·41, and the addition of mineral loading matter to asphaltic (petroleum) bitumen increases its density.

B.S.1858 does not include the determination of density, but it is often useful to know, for example, as a guide to composition. One convenient method, based on the Archimedes principle of weighing in air and in water, is described in C.I.G.R.E. (1950) Report No. 205 [3], and another, involving a specific gravity bottle, is Method G. of I.P.-59/53; under this I.P. designation are given definitions of density and specific gravity.

Bitumens withstand well reasonable conditions of heating, but they tend to harden and change in properties if overheated, especially when fluxed with volatile materials. Although there exists no widely accepted method of test, manufacturers have their own means of assessing the resistance to heating of compounds; these include experience of the constituents and tests simulating severe field conditions.

Oil/Rosin Compounds

There is no British Standard for this class of compound, which is, as a rule, manufactured by cablemakers as a specialty to suit their cable and accessory designs for particular service conditions.

As mentioned earlier, the compounds consist essentially of insulating oil and gum rosin, the proportion of which

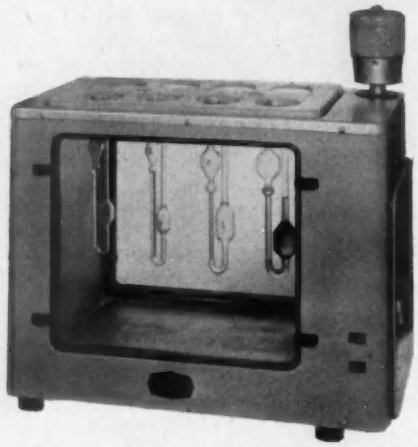

Fig. 7. Bath containing U-Tube viscometers. (Courtesy of Townson and Mercer Ltd.)

is generally 15 to 50% by weight and sometimes higher. Refined rosin is seldom used because of its greater tendency to recrystallise, and the gum rosin has to be selected with this aspect in view as well as others, including electrical; gum rosin is seldom so good electrically, on the whole, as refined rosin.

Being comparatively simple liquids over most of the relevant temperature range, the consistency of oil/rosin compounds is determined viscosimetrically, except at low temperatures; the number of methods of test for consistency is consequently less than for bituminous compounds, and some other tests do not apply. These compounds are therefore subjected to fewer tests, but electrical characteristics receive much more emphasis.

Viscosity and Solidification Temperature

The subject of absolute viscosity measurement is dealt with comprehensively in I.P.-71/53, where it is defined as follows: the viscosity of a fluid is that property to which is due the internal resistance offered to the motion of any portion of that fluid with a velocity different from that of a contiguous portion. It determines the resistance offered to shear, e.g., to slow stirring, to flow through a capillary tube and the like.

The C.G.S. unit for absolute kinematic viscosity is the stoke (s), from which is derived the more generally convenient centistoke (1 cs=0·01 s); water has a viscosity of 1 cs approximately at 20% C.

The methods described under I.P.-71/53(T) are based on glass capillary viscometers; Fig. 7 shows I.P. U-tube viscometers set up in a bath which has pump circulation for the water or oil filling medium, electrical heating with thermostatic control, and levelling devices for the viscometers.

There are several other types of instrument, e.g., falling sphere and rotating cylinder, and the various conventional empirical apparatus still used in some countries, such as Saybolt (U.S.A.), Engler (Germany) and Redwood (Great Britain). All these have jets through which the fluid flows into calibrated receivers, and Fig. 8 illustrates the Redwood viscometer.

These efflux apparatus do not measure absolute viscosity, but for many purposes their test results may be converted into absolute units with sufficient accuracy. The R.E.F.U.-T.A.S. (Kelly) viscosity chart[7, 8] is most valuable in this connection, and Table I[9] gives approximate conversion factors applicable to viscosities above 60 cs.; the relations are more complicated for lower viscosities.

Oil/rosin compounds vary considerably in viscosity, but with few exceptions they are poured satisfactorily at temperatures of about 100° C and lower. Table II shows the viscosity at several temperatures of compounds having different gum rosin contents with the same oil, a viscous oil of the napthalene type; other data are included which are referred to in the next section of this article.

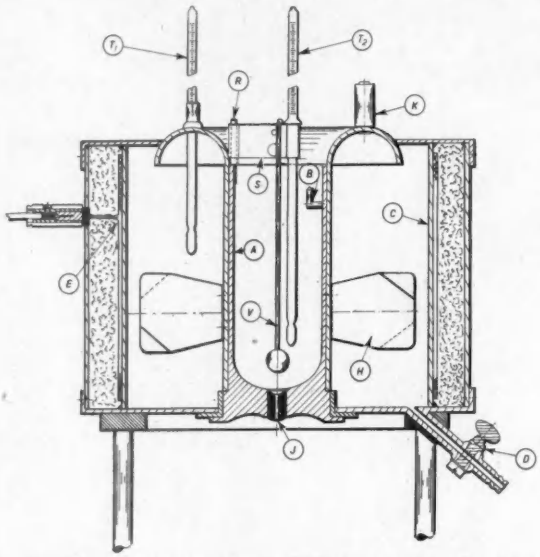

Fig. 8. Redwood viscometer (No. 1). The letters ringed in this sketch are referred to below

A, oil-cup; B, levelling wire; C, copper bath; D, tap; E, heating element; H, stirrer; J, agate jet; K, stirring handle; R, standard; S, thermometer clip, T_1 and T_2, thermometers; V, ball-valve.

On cooling from temperatures at which they are mobile fluids, oil/rosin compounds reach temperatures below which they "solidify" and would cease to flow under service conditions, and with continuing thermal contraction would fail to fill adequately the accessories; this hazard applies particularly to outdoor terminations in some climates, and although resultant breakdown is uncommon, it should be taken into account.

From Table II it will be seen that the I.P. setting point approximates closely to a viscosity of 25 x 10^6 cs, and while

TABLE I.—VISCOSITY CONVERSION FACTORS

Known Viscosity	Desired Viscosity						
	Centistokes	Seconds Redwood I	Seconds Redwood II	Seconds Saybolt Universal	Seconds Saybolt Furol	°E	Seconds Modified Redwood Tar
Centistokes ...	—	4·05	0·405	4·58	0·458	0·132	0·0025
Seconds Redwood I	0·247	—	0·1	1·13	0·113	0·0326	
Seconds Redwood II	2·47	10	—	11·3	1·13	0·326	0·0062
Seconds Saybolt Universal	0·218	0·885	0·0885	—	0·1	0·0287	
Seconds Saybolt Furol	2·18	8·85	0·885	10	—	0·287	0·0054
Degrees Engler ...	7·58	30·7	3·07	34·81	3·48	—	
Seconds Modified Redwood Tar ...	400		162		183	528	

TABLE II.—VISCOSITY (approx.) AND SETTING POINT OF OIL/ROSIN COMPOUNDS

Property		Rosin % by weight, balance viscous mineral oil.		
		15	30	50
Viscosity, cs	20° C	45,000	250,000	$12{\cdot}5 \times 10^6$
	60° C	525	1,200	5,000
	100° C	50	75	125
Redwood Secs.	20° C	180,000	1×10^6	50×10^6
	60° C	2,100	4,750	20,000
	100° C	200	300	500
Temperature, °C at which viscosity is 25×10^6 cs approx.		—10	0	18
Setting Point, °C, I.P.–54/42		—10	0	19

neither value can be interpreted directly into service requirements, it is reasonable to design and select compounds having the lowest solidification temperature compatible with other desirable characteristics.

I.P.-54/42, which was intended for oils and not for oil/rosin compounds, did not appear in the 1953 edition of Standard Methods, but was included during the previous 10 years. The principle of the method is to determine the temperature at which the sample on cooling in a wide U-tube does not move materially under an air pressure equivalent to 5 cm water. The Table II temperatures at which the compounds have a viscosity of 25×10^6 cs approximately were obtained by extrapolation of straight lines drawn through points based on viscosity measurements at higher temperatures appropriate to common viscometers.

(To be concluded)

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2. Standard Methods of Testing Petroleum and its Products. Published annually.
3. No. 205 Report of the Sub-Committee on Filling Compounds for Cable Boxes.
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Activities of the J.A.C.

SAFETY and efficiency have been two of the principal items discussed at some length at meetings of the Local Advisory Committees set up under the National Joint Advisory Council of the Electricity Supply Industry. Some of the items referred to are mentioned in the report of the N.J.A.C. for the year ended 31st March last, just issued. In this it is reported that the National Council made 24 recommendations to the electricity boards during the year, among these being training schemes for supervisors, accountants and linesmen, while others related to marking of fire-fighting equipment, the recording of sickness absence, and the establishment of benevolent funds for manual workers.

The National Council has recommended the Authority and the area boards to accept a scheme for the training of supervisors, which can be applied to manual workers as well as those engaged in technical and clerical work. The scheme is based on three main principals: (1) periods of residential training; (2) continuous local training, and (3) the recognition of, and participation by supervisors in, appropriate technical college courses.

Amendments have also been proposed to the British Electricity Safety Rules for generation, transmission and distribution, and it is expected that a final draft will shortly be agreed bringing greater uniformity between the three sets of rules than previously existed. Possible repercussion of the amalgamation of the Merseyside and North Wales and North Western Divisions, and the proposal of the Authority to close down 23 thermal power stations of less than 1,000 kW capacity, were other matters discussed.

It appears from the report that the progress of the District Joint Advisory Councils was somewhat uneven; in general they did not themselves originate many subjects for discussion, but considered many items referred to them by the National Council and the L.A.C.'s. Nevertheless, the Report states that several of them made a substantial number of recommendations of consequence to the boards and the divisions and did much useful work in furthering the development of the L.A.C.'s in their districts. One of the points which arose concerned the number of accidents caused by lifting modern types of streamlined cookers and other modern electrical equipment. A modified metal lifting cradle is now being tried out by one Board to overcome these difficulties.

The section on the work of the L.A.C.'s is a valuable one for it gives a detailed analysis of their work under the various headings. Reference is also made to the efforts which the National and district councils and many of the boards have made by different means to encourage the L.A.C.'s to broaden the scope of their discussions. It appears that these efforts have been fairly successful.

There was evidence to suggest that many L.A.C. chairmen realised that joint consultation is a valuable aid to good management and that they are approaching the work of their committees accordingly.

The remainder of the Report, in addition to including many examples of the work of the particular advisory councils and committees, consists of general sections on a number of subjects. On the British Electricity Scholarship scheme, it is stated that during the year covered by the report, 161 applications for scholarships were received, compared with 248 applications in the previous period, the first year of the scheme. Examples of the value of the Employees' Suggestion Scheme are also given, together with illustrations of some of the devices adopted. Many of our readers interested in dealing successfully with problems of human relations in industry will find much of interest in this report. Employees in the Electricity Supply Industry can get copies from their L.A.C. secretaries; others may obtain them from Mr R. D. V. Roberts, secretary, N.J.A.C. of the Electricity Supply Industry, Winsley Street, W.1.

Research on

Intensive Attack to

A germanium power rectifier for electric vehicles. Note the aluminium cooling fins

THE peculiar properties of the class of materials grouped under the general name of semi-conductors have been under intensive investigation, both in this country and abroad since the war. Possibly the earliest use of semi-conductors commercially was in the first days of wireless when the cats-whisker crystal was extensively used as a detector. The rapid development of the thermionic valve, however, caused the cats-whisker detector to fall into desuetude, but, in the last war the need for a satisfactory mixer or frequency changer in ultra-high frequency radar equipment again brought it back into the limelight, and in fact the silicon crystal diode was developed into a high state of efficiency and robustness.

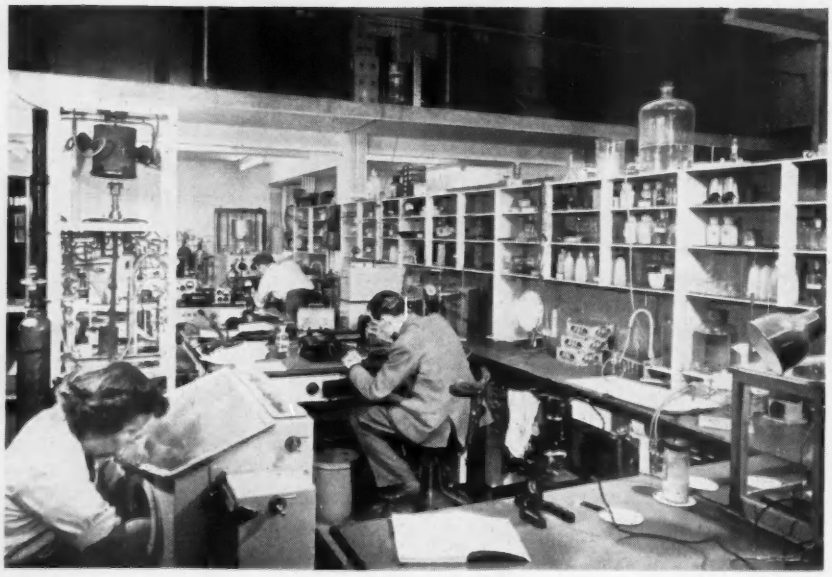
Tremendous impetus was given to research on semi-conductors by the discovery of the transitor in 1948, when Bardeen and Brattain of the Bell Telephone Laboratories found that a triode amplifier could be made by arranging for two very close point contacts on one side of a germanium slab with a third contact area on the other side. About two years later, another milestone was reached with the discovery of the p—n junction rectifier. Essentially this consists of a block of germanium, one part of which has an excess of "p" type impurities (atoms that will accept electrons) and the other with an excess of "n" type impurities (atoms that will donate electrons). This combination provides an excellent rectifying effect. Yet another device, the junction triode, was then developed using p.n.p. or n.p.n. combinations, an important feature of these classes being that they can cater for positive or negative control voltages.

In view of the foregoing it became obvious that the future potentialities of semi-conductors in many fields of electrical engineering were immense, and it was decided by the General Electric Co. to establish a research group of considerable size to investigate the matter. A large two-storey wing has been built at the Wembley Research Laboratories, and includes departments whose work is divided into solid physics, material preparation, devices and electronics.

Basic Research

Fundamental work on the properties of semi-conductors and into the discovery and development of new materials is vital, and the laboratories are already making, and investigating the properties of; a new group of compounds with a crystal structure closely allied to that of germanium. Known as chalcopyrite materials, they have interesting semi-conducting properties. For example, copper indium selenide ($Cu\ In\ Se_2$) has shown point contact rectification with peak inverse voltages of about 400 V.

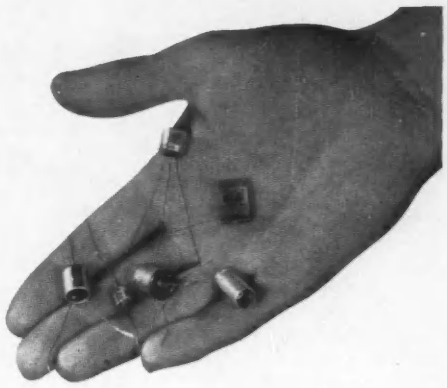
The second main purpose of the fundamental research group is to give a greater insight into the physical properties of semi-conductors. This field is relatively undeveloped but already many unusual effects, thermal, optical, and magnetic, as well as electrical, have been discovered. Some semi-conductors, e.g. bismuth telluride, exhibit a pronounced Peltier effect, and a junction of metallic bismuth with its telluride can be used to produce a difference of 26° C.



The semi-conductor development section of G.E.C. research laboratories at Wembley with (right) two phases in the development. In the first picture the operator is withdrawing a single crystal ingot from the furnace in which it has been formed by the solidifying of molten germanium on a small rotating crystal seed. The second picture shows germanium being purified by a zone technique which involves the passing of a series of molten zones along the ingot contained in a graphite crucible. The zone is produced by eddy current heating

Semi-conductors

Utilise Properties to Full



A selection of germanium devices showing small size

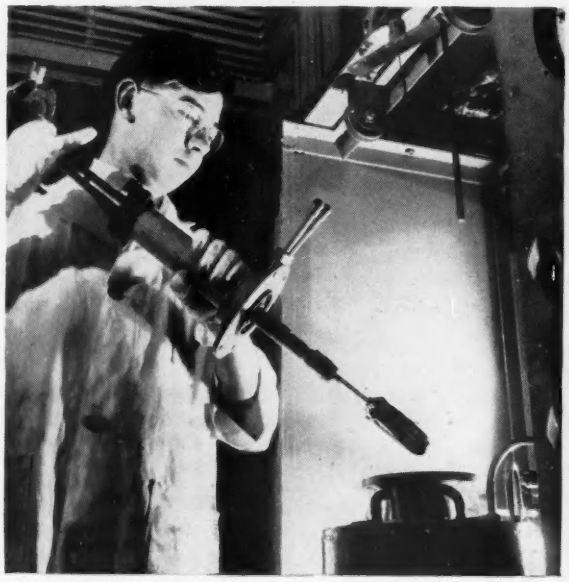
Fundamental studies show that the phenomena on the surface of a semi-conductor are of vital importance, and much work remains to be done before these phenomena are understood. As an example of surface effect, a bombardment of a material by ions can produce a remarkable permanent improvement of the rectifying characteristics.

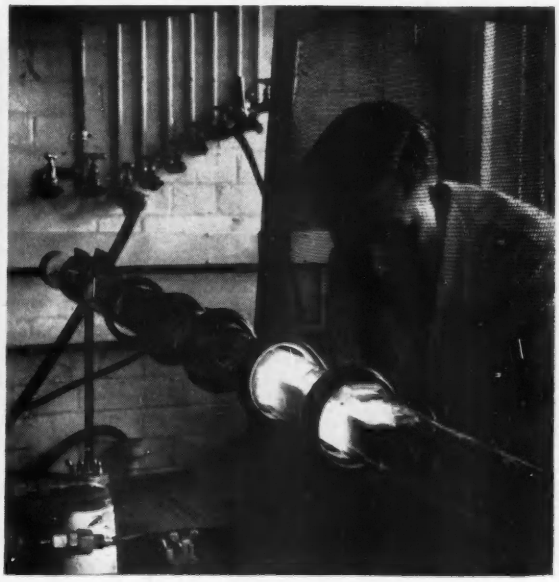
Preparation of Materials

Germanium provides a good example of the difficulties associated with the preparation of semi-conductors. This metal, once a scientific curiosity, is obtained by British manufacturers from the dust and soot which collects in the flues of gasworks, particularly where Northumberland and Durham coals are used. It is usually present as 0·5—1·0% by weight in the better flue dusts. After an elaborate chemical preparation the germanium arrives at the laboratories in the form of germanium dioxide which is then reduced to a raw metal by a reduction under high temperature in an atmosphere of hydrogen. The metal thus obtained is fused and cast into an ingot. At this stage, the impurity content represents about one part to every ten million parts of germanium. This is still about 100 times as impure as is required for semi-conductor devices. The further necessary purification is accomplished by means of a technique known as zone refining. Only a small section of the ingot is melted at any one time, and due to the selective absorption of impurities by the liquid phase, the molten section containing the impurities can be moved along the ingot to one end, which is then sawn off. It is an interesting fact that the degree of refinement obtained by this method is so high that there is no means of proving it except by the actual performance of the metal when it is used in a semi-conductor application.

Having attained the degree of purity required it then remains to convert it into a single crystal. The metal is again melted, this time in a crucible, and a minute controlled amount of the necessary impurity added, a small "seed" of monocrystalline germanium is dipped into the molten mixture and a single crystal can be grown. This is then sawed up into small sections which are used in the production of semi-conductor devices.

Fundamentally, all the interesting electrical properties of semi-conductors take place either in metal/air layers or in intermediate layers lying between metals of differing characteristics. One of the difficulties found with the junction transistor, for example, lies in the finite time taken for charge carriers to migrate between emittor and collector. To reduce this time, the thickness of the germanium wafer must also be reduced, and satisfactory operation can be attained at 10 mc/s if the thickness is of the order of 0·0005 in. Electrolytic techniques have been devised to etch germanium within controllable limits of 0·0001 in. Distance between emittor-collector spacing is also of importance, and in commercial items is of the order of 0·003 in. For higher frequency work this may need to be 0·0005 in. for 100 mc/s. For such precision assembly limits, problems of construction become immense, but it has been found that micrometric manipulators can be made and comparatively unskilled labour used.





READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Safety with Portable Tools

I READ Mr T. C. Gilbert's article "What are we doing with Safety" with great interest and enjoyed his logical and straightforward arguments. There are one or two points I would like to take him up on, however. Firstly, he was incorrect in stating that the writer's paper, presented to the I.E.E., "crystallised the view of the Engineering Equipment Users' Association" since, in fact, opinion amongst member companies is divided on the subject of low voltage. The writer's conclusions are opposed by other member companies of the Association, some of whom strongly favour 50 V supplies using fixed transformers or portable mains voltage transformers having insulated casings and special earthing arrangements.

Now for Mr Gilbert's remarks on monitored circuits. I am with him whole-heartedly when he says that with low and medium voltage equipment the duration of the shock is more important than the voltage. Cut the supply within a few thousandths of a second of the "fault to casing" occurring and the shock danger is minimised if not completely eliminated. An earth leakage trip is admirably suited for this function if its trip coil is connected between the casing and earth.

Unfortunately, the trip coil will not be so connected if the earth core of the flexible cable is broken or disconnected at either end or if there is a lack of continuity between earth pin and tube of the plug and socket. Any fault occurring between live metal and casing in such conditions will result in full mains voltage appearing on the casing of tool until the supply is interrupted manually.

This dangerous possibility can be avoided by duplicating the earth core of the cable and monitoring the loop so formed, using a small transformer and a relay, a technique referred to by Mr. Gilbert as "surrounding the simple little voltage operated earth leakage circuit-breaker with all kinds of additional accessories and hanging it round with complicated circuits." To dismiss as "over-complicated" the transformer and relay whilst accepting the circuit-breaker is surely straining at a gnat and swallowing a camel. As was mentioned in the I.E.E. paper, the monitoring can be extended to the fixed part of the earth path as well as the more vulnerable earth core of the flexible cable. However, the writer feels that the expense per supply point limits the application in general to 3-phase equipment and recommends recourse to low voltage for single-phase tools.

The prices quoted by Mr Gilbert are not competitive! A 3-phase monitored earth unit in a splash-proof case, complete with plug and socket costs less than £15 and this might be reduced if the units are brought into more general use.

J. W. Bunting,
COVENTRY, WARWICKSHIRE.

Economic Cable Sizes

MAY I reply to Mr J. H. Field's letter in your "Readers' Views" of 26th August in which he makes certain criticisms of my article on 12th August on the selection of economic cable sizes.

My main aim in writing the article was to draw attention to an unfortunate tendency to ignore the economic problem. Secondly, I wished to show how the basic principles of Kelvin's Law could be applied to cables supplying growing loads, by means of a relatively simple formula. And, finally, I gave a short example, to show how the formula could be used, and discussed very briefly some of the other technical and practical considerations which must be taken into account before an answer is arrived at.

With all the points raised by Mr Field I am in entire agreement, but to have gone into full and detailed discussion of all these factors in relation to the particular example chosen would have resulted in a much longer article, and would, I thought, have been rather tedious. I hope, therefore, that readers will not interpret my short example as an "exact" solution which can be applied indiscriminately to all similar circumstances. I emphasised in the conclusion to my article that the economic problem is only one of several technical and practical factors which must be considered. Depending upon the weight given to these other factors, therefore, different engineers may well arrive at slightly different answers in practice. My article has served its purpose, I think, if it has drawn attention to the importance of including the economic aspect in one's considerations in a logical manner, and giving it due weight as one of the several factors involved. The methods described in the article provide, I think, a convenient way of doing so.

J. H. Sumner,
KUALA LUMPUR, MALAYA.

Earth Continuity Circuit Impedance

I HAVE been very interested in your summaries of various interpretations of the I.E.E. Wiring Regulations, especially that relating to the testing of earth continuity circuits, as described in your issue of 12th August One assumes that the object of this test is to ensure the operation of the circuit overcurren protective devices under fault, whilst limiting the leakage potential on conduits and the frameworks of connected equipment to 40 V.

This test would appear to be adequate for final sub-circuits protected by means of H.R.C. fuses or small circuit-breakers, and which might reasonably be relied upon to operate with the 1½ times final sub-circuit rating suggested. We have to realise, however, that at present and probably for some considerable time to come the majority of final sub-circuits are protected by no more efficient devices than rewirable fuses, and for which a fusing current of 2½ times the rating must be allowed.

It is agreed that the testing of an earth continuity conductor with 2½ times the circuit rating will be a considerable nuisance, but this problem has been so inadequately tackled in the past that it would be lamentable if under the new requirements of the Regs. it cannot be cleared up once and for all. Perhaps other readers will have an explanation of the 1½ times the rating requirement, and will say if they consider it adequate.

T. C. Gilbert,
FOLKESTONE, KENT.

From an Engineer's Notebook

THE regular monthly feature, "From an Engineer's Notebook," has been omitted from this issue as our contributor, "E. R. G.," is at present on holiday.

Research in Scotland

A Review of Some Current Projects of Electrical Engineering Interest

TODAY'S opening of the Scottish Industries Exhibition in the Kelvin Hall, Glasgow, provides an appropriate occasion for a reminder that Scotland is prominent not only in the manufacture and marketing of engineering products, but also in the research that plays so important a part in all technical development. It is appropriate that, amongst the attractions of Glasgow while the Scottish Industries Exhibition is open is a "Research in Industry" Exhibition, at which over 100 exhibits of scientific equipment from industrial, university and Government research laboratories will be on view. Apart from the mention of this exhibition, however, it is not the purpose of this article to review the research effort of individual firms. Rather, it is the contribution of Scottish laboratories, universities and public corporations to the overall British research effort in the field of electrical engineering and related subjects that is considered. This is seldom seen as a whole, although records of individual projects appear frequently enough.

University Research

For a country with the educational reputation of Scotland, the universities provide an appropriate starting point. Two establishments which in their time have made notable contributions to electrical engineering progress must here serve to represent all the Scottish work in this field. They are the Heriot-Watt College in Edinburgh, and the Royal Technical College, Glasgow.

Professor M. G. Say is Professor of Electrical Engineering at the Heriot-Watt College, and amongst research projects for which his department has recently been responsible may be noted the design and construction of a network analyser for solving electrical machine problems. This analyser works at 2·4 kc/s, and makes use of a 90° phase rotation in its representation of circuit quantities; that is, resistance is represented by capacitors and inductance by resistors. The one item of electrical rotating machinery theory at present being developed involves the double-fed induction machine. Development and experimental verification of a general theory of complex a.c. machines is the form this programme takes, particular attention being given to effects which, although important, are of the second order of magnitude.

A study is being made of the responses of basic servomechanisms, with the object of enabling transient response to be predicted accurately from the harmonic response. A somewhat related programme is concerned with developing a graphical process for the solution of second-order differential equations having non-linearities, where these are analytic or non-analytic, or based on experimental data.

Two other programmes are worthy of note. The first adopts a broad approach to the transistor, and involves a study of the characteristics of crystal diode and triode circuits under various physical conditions. A search is being made here for methods of increasing the frequency range of transistor applications, and for ways of obtaining arrangements comparable to multi-electrode valves. Finally, there is an investigation into the generation of oscillations in passive electrical circuits by electrical or mechanical means, with particular attention to the "jump" and "hysteresis" phenomena not previously mentioned in the literature.

At the Royal Technical College, Glasgow, the head of the Department of Electrical Engineering is Professor F. M. Bruce. The College has 15 post-graduate research students working mainly for the Ph.D. degree. Their individual research programmes are selected from one of several main fields of work for which special facilities have been provided. The combined results of each group represent an appreciable research effort.

High voltage and heavy current problems provide the subjects for the largest group. Work on the mechanism of the electric spark is based on a study of breakdown in the uniform field between parallel plane electrodes, with subsequent extension to other types of electrodes. An impulse calibration for the uniform field gap has recently been completed which agrees well with the a.c. calibration. A further a.c. calibration and a d.c. calibration are in hand. These calibrations are providing the basis for a study of the effects on breakdown of atmospheric humidity, irradiation, and electrode surface conditions. An initial survey of breakdown in high vacuum has been completed. Special experimental and measurement techniques have had to be developed to enable this work to be carried out, and photographic studies of suppressed discharges are used to supplement the data from oscillography. High speed electro-optical shutters are used.

For the study of arc phenomena, the Department has equipment capable of providing kiloamperes at kilovolts for several cycles. Special attention is being given to the design of arc control devices for air circuit-breakers. The electrical characteristics of the arc are obtained on a high speed multi-channel c.r.o., while simultaneously a high-speed cinematograph record is made of the movement of the arc within the arc chute. Some work has also been carried out on contact erosion due to arcing on repeated making and breaking of power circuits.

Interest in the spark and the arc is combined in an investigation of the conditions under which a power arc will develop following an impulse flash-over on an energised system. A new h.v. laboratory for work up to 1·5 MV should be available before long, and will doubtless be of value in this work.

Other research programmes at the College must be noted briefly. A group is developing in the field of servomechanisms, and an investigation into the production and detection of millimetric waves has been in progress for some years.

D.S.I.R.

The Department of Scientific and Industrial Research has had a Scottish branch office for many years, and some of its establishments have offices or laboratories in Scotland. It is only recently, however, that one of the main laboratories was established there. That is the Mechanical Engineering Laboratory, which has gradually been transferred to the new town of East Kilbride. Its laboratories

are still in the process of being built, but already it is contributing many results of importance to the electrical industry.

As a start, note may be taken of the work on high speed bearings, such as those required in gas turbines. The reliability required in such work is considered to be greater than can be expected from ball- or roller-bearings operating at the speeds concerned, and the use of journal bearings is therefore being investigated at the Mechanical Engineering Laboratory. Lubrication is the crux of the problem, and new techniques are being evolved for measuring factors relevant to this.

The laboratory is also concerned with ball bearings of the highest dimensional accuracy combined with minimum frictional torque. Bearings of this kind may be required for small electrically driven instruments. Bearings running at speeds from 10,000 to 50,000 r.p.m. with axial loads up to 15 lb and radial loads up to 10 lb are being tested in a new machine developed for the purpose. A relationship is sought, between dimensional accuracy and frictional torque at the speeds mentioned.

As mentioned above, parts of the laboratory have yet to be built, and included in this category is the Heat Transfer Laboratory. When it comes into operation, some of the work on thermodynamic measurements and on the combustion of liquid fuels, at present carried on under extra-mural contracts, will be transferred to East Kilbride.

Finally, in this survey of this Scottish branch of D.S.I.R. may be considered the Mechanics of Fluids division. Work here includes attention to a matter of great importance in hydro-electric work: the accurate measurement of large water flows. Many methods are being explored, and a wide range of equipment has been installed in the Hydraulic Machinery laboratory to forward this work. There is also interest in the possibility of checking the efficiency of hydraulic machinery by tests on models with flow rates less than 50 cu ft/sec., rather than by full scale tests. The division is further interested in the design of centrifugal pumps, which have so many applications in power engineering. Special attention is being paid to conditions in the volute of such pumps, and to the effects of impeller/volute interaction.

H.E. Board

Few aspects of Scotland can be discussed without some mention of the North of Scotland Hydro-Electricity Board. Research is certainly not an exception. An immediate example bearing on the subject just discussed, hydraulics, may be quoted from the last report of the Board. On its behalf, investigations into such hydraulic problems as the shape, position and size of various structures have been undertaken by the engineering departments of a number of Scottish universities and technical colleges. The development work by the Board has also entailed the construction of models on site so that designs of flow channels, etc., could be checked. Such work has been carried out by resident staff of the Board's consulting engineers.

An important part of the Board's work is inevitably the building of dams, and here it has given close attention to the evolution of price-saving methods. An example is the use of fly ash from thermal power stations as a partial replacement for cement, in concrete dams. A trial with this is being made at the Lawers dam, which is being built in connection with the 30 MW, 880 m units/year station at Finlarig. In the Cluanie and Loyne dams of the Upper Glen Moriston scheme, concrete made from blast-furnace slag by the Trief process is being used. The Allt-na-Lairige dam, 73 ft high and 1,375 ft long will be the first in Great Britain to use pre-stressed concrete in its construction.

Wind-power has also attracted the attention of the Board, and it is closely concerned in the tests that are being made with a 100 kW windmill at Costa Hill, 20 miles from Kirkwall, in the Orkneys. Recent reports state that during its successful run last November, the hub of the windmill was overstressed. Since that time the "sails" have been shortened from 22 ft in length to 17 ft. Tests are again in progress, and there is a hope that extensive trials may be carried out later this year.

Perhaps the most exciting of the Board's research and development projects concerns peat. In this, it is collaborating with the Scottish Peat Committee. The Clydebank works of John Brown and Co. are building a 2 MW closed-cycle peat-fired gas turbine for erection on a Scottish peat moss at Altnabreac. This is to be fired with milled peat, and if successful must lead to an increased consumption of the 600 m tons dry weight estimated workable reserves of Scottish peat. It has been further recommended by the Scottish peat committee that the Board should bring into operation on the same moss the 750 kW open-cycle peat-burning gas turbine which is being developed by Messrs Ruston and Hornsby for the Ministry of Fuel and Power.

Nuclear Energy

One other electricity generation research project of note is outside the direct province of the North of Scotland H.E. Board. This is the erection of a large breeder reactor at Douneray, in Caithness as part of Great Britain's nuclear power programme. For safety's sake this reactor is to be housed in a large spherical steel shell, so that if there should be any trouble, the radio-active results will be contained. A large open site was needed for the project, together with coastal access for the disposal of the effluent from the station and the provision of cooling water. In addition, a large supply of fresh water was required. Scotland was readily able to meet these needs, and so to become the home of the most advanced type of reactor at present being built in Great Britain, and one which may lead to great economies in the requirements of uranium for power production purposes.

Research Exhibition

The exhibition which was mentioned at the beginning of this article, and which summarises Scotland's contribution in the field of research, is being organised by the Kelvingrove Museum, which is opposite the Kelvin Hall, with the co-operation of the D.S.I.R. Outside the museum buildings will be seen for the first time in Scotland the Production Engineering Research Association's mobile trailer exhibition, which includes a cinema and an information bureau. The "Research in Industry" Exhibition will run from 4th September until the end of the Scottish Industries Exhibition, and during this time it will be open from 10 a.m. to 9 p.m. every day except Friday, 10th September, when the closing time will be 5 p.m.

As a final note to this brief review of one sector of Scotland's research effort, it is interesting to note a project which may fairly be described as research on research. Announced at the end of March, it takes the form of an experimental survey to find means of conveying the latest scientific and technological information to medium-sized and smaller firms in Scotland. This work is being undertaken by the Scottish Council (Development and Industry). In earlier considerations of the problem, this body had concluded that the primary need was for a scientific visiting service. As a trial, a team of investigators will visit firms.

The Scottish Industries Exhibition

2-18 SEPTEMBER 1954

Opening today at the Kelvin Hall, Glasgow, is possibly Scotland's biggest industrial event of the past five years. Gathered together under one roof is the country's contribution to the markets of the world; a contribution which has increased very considerably since the previous Scottish Industries Exhibition was held in 1949. Strenuous efforts since the war to widen the scope of industry north of the Border are bearing fruit and excellent examples of this development may be found in almost every county. Nor has the electrical industry lagged behind, as the large proportion of electrical exhibitors at the current exhibition shows. The event has been well publicised the world over, and the 1949 attendance of over 500,000 and the value of orders received of over £10,000,000, must surely be easily exceeded. The Exhibition, being opened by H.M. Queen Elizabeth, the Queen Mother, is confined to goods actually made in Scotland. The following is a brief account of some of the electrical exhibits.

BEGINNING our preview with the displays by manufacturers of heavy equipment probably one of the most impressive is that of Babcock and Wilcox Ltd. That firm has a large type E coal pulverising mill fitted with "Perspex" windows, and driven at slow speed for easy viewing. One of the exhibits features the new atomic power station being built at Calder Hall, where the company's steam raising plant is being installed. Models shown include one of the 540,000 lb/hr cyclone-fired boilers under construction for Barking C power station. The stand also includes a cinema at which Babcock films will be shown. Equally impressive is Bruce Peebles and Co. Ltd's large scale model of a complete 24,000 kW hydro-electric scheme with a scenic setting to show every step in taking power from the generating stations to consumers. Transmission is demonstrated by a large mural in colour of a 120,000 kVA 275,000 V transformer now on order for the British super-grid.

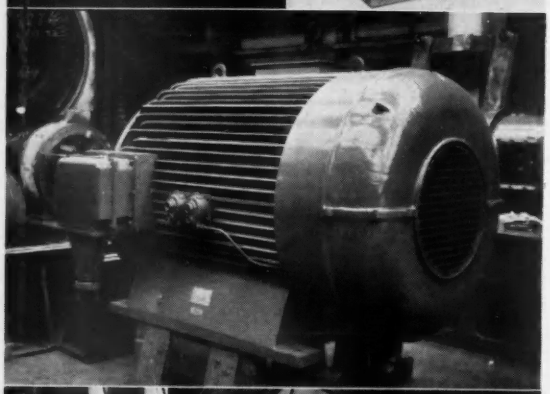
A range of goods typical of the products of their factories at Germiston and Motherwell are shown by Metropolitan-Vickers Electrical Co., Ltd. The main items are an air-cooler for closed circuit ventilation on large a.c. generators; an oil-cooler for steam turbine lubricating systems, and oil-cooler tube nest; and vertically-isolated switchgear type VH. A coil-winding machine for bi-metal strip, Sunvic controls and numerous instruments and meters are also shown.

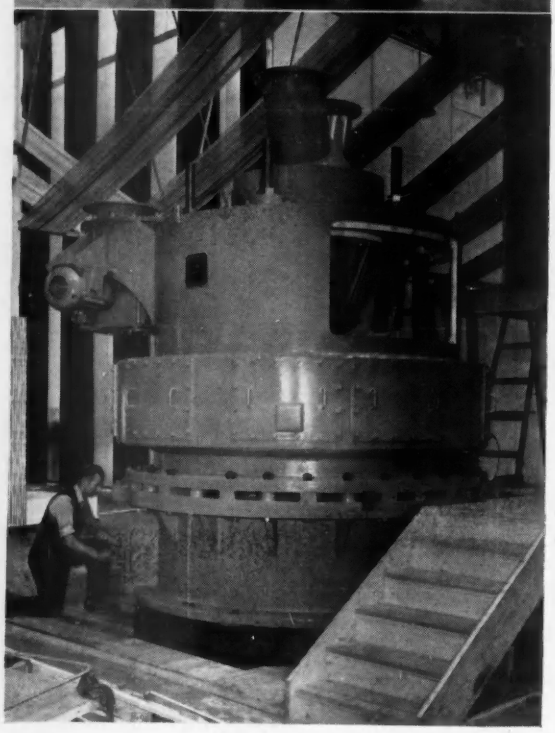
On view for the first time at this exhibition is the Harland Engineering Co. Ltd.'s Rotovalve, and a full-sized 24 in. hydraulically operated unit weighing 6 tons is the centrepiece of the stand. General design is essentially the same as that of a plug cock but the difference lies in its ingenious yet simple operating mechanism. Orders have been placed for the Rotovalve by the Hydro-Electric Board and others. From their range of centrifugal pumps, electrical machinery and hydro-electric plant, Harland are showing a submersible pump set. Also of note is the working scale model of Loch Striven power station showing a Francis type water turbine driving an alternator.

British Electrical Repairs Ltd are well represented at the exhibition. This company is concerned with a variety of equipment, including armature stator transformer coils, generators, slip rings, commutators, shafts, bearings and tapping switches, and a wealth of information on their activities is freely available. Aluminium alloy castings and assemblies made by sandcast gravity diecast and high pressure diecast processes are the special and notable

HOURS OF OPENING
Daily (except Sundays) 10 a.m. to 10 p.m.

ADMISSION CHARGES
Daily (except Saturdays)
10 a.m. to 12.30 p.m. 3s.
12.30 p.m. to 10 p.m 2s.
Juveniles half-price after 12.30 p.m.
Saturdays.
All day 2s.
Juveniles half-price.





products of Renfrew Foundries Ltd., who also exhibit in the engineering section.

In the field of switchgear, examples of air-break switchgear and automatic motor control gear both for industrial and flameproof applications up to 650 V are exhibited by the Belmos Co. Ltd. A recent introduction to the latter range is a star-delta starter for motors up to 15 h.p. at 440 V. In view of the importance of power factor correction we note a control cubicle for a six stage installation which is on view. A comprehensive range of electrical switch and control gear is also shown by M. and C. Switchgear Ltd. By no means least in this category are W. and H. Nelson, Ltd., whose Nelbest switchgear includes flameproof and non-flameproof equipment covering controllers, resistances, circuit-breakers and panels. This firm's products extend also to contactor starters, distribution units, switchboards, and single, double or four-tier cable joint boxes.

The Haigh alternating stress and Haigh-Robertson fatigue testing machine for wire are featured by Bruntons (Musselburgh) Ltd. Their latest fatigue testing machine operates at 6,000 stress cycles per minute. Bruntons' main products are high grade steel wire and steel wire ropes, for all uses in the mining, shipbuilding, engineering and aircraft industries.

Electric derrick and overhead travelling cranes are among the well-known products of Anderson-Grice Co., Ltd., also exhibiting.

Mining Equipment

Mining engineers will find plenty of interest on the stand of the Wallacetown Engineering Co., Ltd., who specialise in the manufacture of flameproof mining type switch and control gear of the air-break pattern. Numerous examples of their present range are being shown, but it should be noted that their activities have led to the development of industrial type equipment utilising standard mining pattern, and a cross section of this range is also displayed. For those whose responsibility is the safety of miners there is Mine Safety Appliance Co., Ltd.'s stand. They are sole distributors of the Edison electric cap lamp. In addition viewers will see the MSA charging racks, the Methanometer, the explosimeter, portable and fixed gas recording and alarm units, and the comparatively recently introduced Dustfoe respirator.

A variety of instruments are featured by Kelvin and Hughes Ltd. Among them are the lossmeter to check flue gases; the flue gas analyser, a newly-designed instrument using a venturi type aspirator; circular chart recorders and a fugitometer, another newly-designed instrument. Kelvin Shadowless lamps and the Ampro recording projector are also displayed.

Land and marine power plant auxiliaries are well in evidence on the stand of G. and J. Weir Ltd.; a special feature being an animated flow diagram of the closed feed system for ships. A second stand in the engineering section is devoted to the products of Drysdale and Co. including a selection of pumps for use on land and at sea.

Ferranti Ltd. are playing an important role in the development of the Scottish electrical industry, particularly in sharing the knowledge gained by their research organisa-

Top left is the Belmos Co.'s control cubicle for a six-stage automatic power factor correction installation, and right Kelvin Hughes Fugitometer for fading tests under stable conditions of temperature and humidity. Centre is a tube cooled industrial type motor by Bruce Peebles and Co. At the foot is a type E.64 coal pulverising mill being assembled on Babcock and Wilcox Ltd.'s stand. It is destined eventually for Taaibos power station in South Africa

tion. Exhibits cover various aspects of the firm's activities and include Xerography and meter testing. Also shown are their airstream direction detector, gyroscopic gun-sight, "Pentland" series resin cast components, T.R. cells, and integrated microwave test bench. Of electronic interest are the exhibits of Atkins, Robertson and Whiteford Ltd, who are showing transformers up to 10 kVA, a sequence timer, standard and high speed electronic counters, and an electronic milli-second timer.

Portable and wall mounting transformers suitable for low voltage lighting and machine tools are among the products made and shown by John Drummond (Engineers) Ltd. All-insulated test lamps and the firm's earth loop impedance tester are also prominent on this stand.

Stewarts and Lloyds Ltd, and Tubewrights, Ltd, have managed to include a full picture of their achievements. Among the former's exhibits are examples, models and photographs of such items as boiler tubes, steam pipes and lighting columns, while Tubewrights by similar means depict their materials handling equipment, cable drums, and transmission and floodlighting towers. Glenfield and Kennedy Ltd's stand will feature items of indirect interest to the electrical industry, exemplified by models and photographs of appliances for hydro- and thermal-electric plants, water supply, irrigation and industrial services.

For a full range of fractional horse-power motors a visit to the stand of Hoover (Electric Motors) Ltd, will prove profitable. Examples of the many types made at the company's Cambuslang works include their shaded pole motors and stator-rotor units. Prominent too are the induction type used for a wide variety of purposes with machine tools, pumps, air conditioning and other plant.

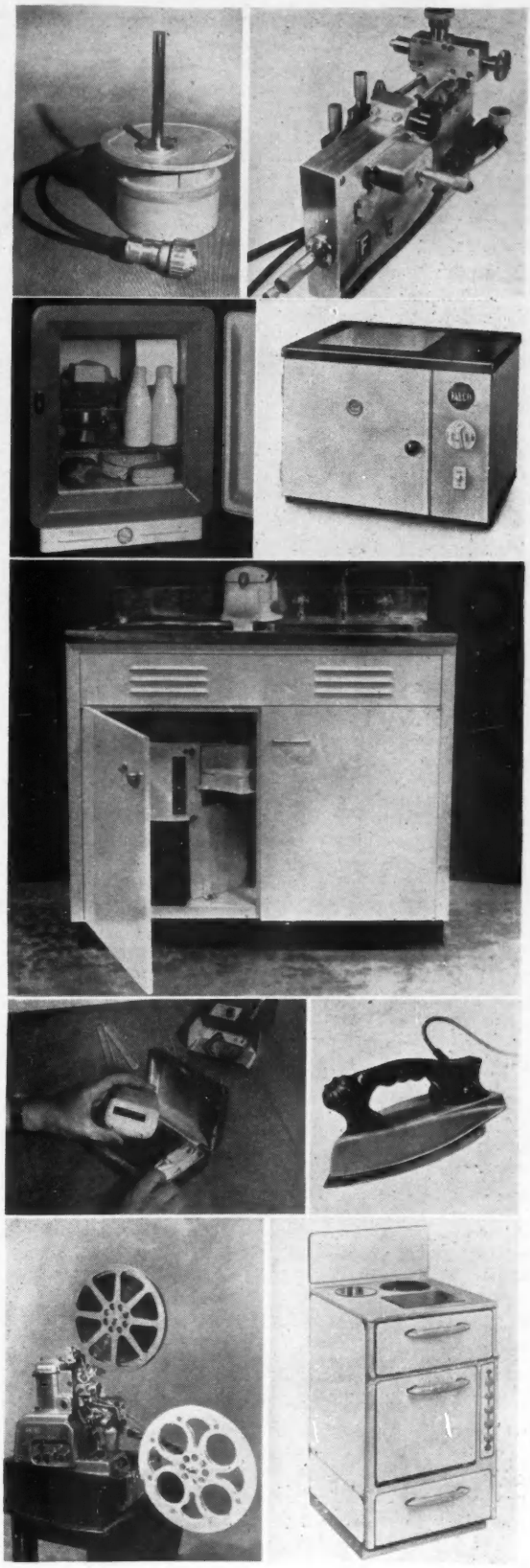
Samples of various cables with joints and terminations are shown by Scottish Cables Ltd. We note that one is protected with a Renex sheath, a composition developed by the company for the protection of lead sheathing against chemical and electrical corrosion. Another exhibitor in the cable industry is Craigpark Electric Cable Co., Ltd. Ioco Ltd are providing a selection of insulating cloths and tapes, laminated sheets and tubes, and similar materials. Perforated cable trays are among exhibits of Fredk. Braby and Co. Ltd.

Contracting and Domestic

The contracting organisation of James Kilpatrick and Son Ltd has done much to further Scotland's industrial reputation both at home and abroad. A pictorial display of the service provided is the main exhibit on their stand, supported by a workshop assembling switchgear into modern control panels and a continuous display of armature winding and electric motor repair.

Linking the industrial and domestic sides of the electrical industry is the B.E.A.'s stand. Main theme is "Electricity speeds Production," and the display is a joint effort by the three Scottish Electricity Boards, the Scottish Divisions and the Electrical Development Association.

The exhibition also provides a fair selection of domestic appliances. A late choice of items to be featured was made by Allied Ironfounders Ltd, who chose two fires and two



Ferranti's exhibits (top) include their airsteam direction detector and integrated microwave test bench. Coming down the page are Astral Equipment Ltd's table top refrigerator, and Falkirk Iron Co's Falco-Petite cooker. Next is Eeze Kitchens Ltd's sink with Prefect washer; Remington's electric shaver and Scottish Precision Engineering's Superflow iron. At the foot are Kelvin and Hughes' Ampro recording projector and B.N.E.'s C.90 cooker

cookers. Fires are the 1 kW Falco No. 39 and 2 kW Falco No. 41. In the cooker line their selections were the attractive little Falco-Buxton, and the Falco-Petite measuring just 15 in. in length, 11¾ in. wide and 12 in. high overall. If small appliances are required, Astral Equipment Ltd are emphasising their two 1½ cu ft refrigerators. Sales of the Freestanding model, in its first season, have exceeded even the makers' optimistic forecasts, while the redesigned Table Model is now making its debut in the market. The latter, admirable for a tiny kitchen is available, thermostatically controlled.

To return to cookers, following its successful debut at the B.E.P.C., the C.90 cooker will again be the main attraction provided by British National Electrics Ltd. For kitchens in general we look to Ezee Kitchens Ltd, who are showing their small L-shaped unit with sink and drainboard and built-in Prestcold refrigerator, B.N. Ezee cooker, counter units and wall cabinets. Specially designed for the popular market are the 42 in. units incorporating the Mark II Hoover and Prefect clothes washers.

Particular emphasis is being laid by Scottish Precision Engineering Co on their Superflow iron. Lamps of all shapes and sizes and for wide variety of purposes are exhibited by Philips Electrical Ltd, not forgetting their Philishave dry shaver. Another shaver of note is to be found displayed by Remington Rand Ltd, the Remington 60. Electric heating by various means may be seen in the display of Duncan Low Ltd, who make water heaters, oil heaters, steam boilers and flameproof radiators.

Latest developments in the field of factory and office intercommunication are impressively displayed by Modern Telephones (Gt. Britain) Ltd.

The "material of the future" — Fibreglass reinforced plastics—is the claim of Fibreglass Ltd who are showing a number of items, such as switch boxes, Belisha beacons, an electric motor, and sleeving, as examples of the uses of their reinforcement material. The I.C.I. stand is of note despite the fact that it is concerned mainly with textiles, for space is devoted to the development and manufacture of silicones. Rust removing and rust inhibiting properties of Jenolite rust remover and neutraliser are shown by Jenolite (Scotland) Ltd. The application of plastics is the special interest of Arnoplast Ltd, who are showing moulded and fabricated thermo-plastics, "Perspex" and p.v.c. for the electrical and other trades.

BRICKS FROM FLY ASH

Successful research shows up to 85% of ash may be used

WITH some two million tons produced annually by the B.E.A. at present, the disposal of fly ash presents an ever-growing problem and although it may be used as a partial substitute for cement in concrete, there are few uses which offer a prospect of using this generation by-product on a substantial scale. The discovery, however, that bricks can now be made using up to 85% of fly ash (announced last week by the D.S.I.R.) opens up a possibility of disposal on a larger scale than hitherto. The statement adds that the B.E.A., who sponsored the work at the Building Research Station which resulted in this development, is now considering building brickworks at power stations, whilst the Midlands Division, in which considerable research on this subject has also been undertaken, has, we understand, gone so far as to consider purchasing a local claypit which yields supplies of suitable clay.

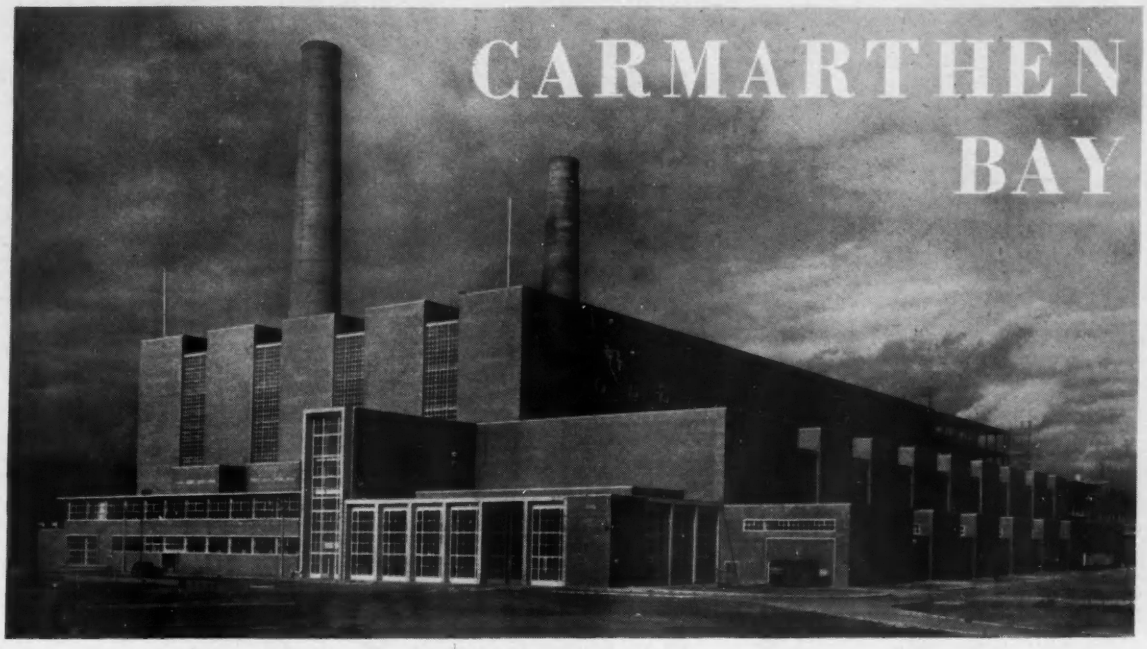
High Proportion of Ash Used

Although the use of small amounts of fly ash (up to 20%) is not new in brickmaking, previous attempts to increase the amount of ash in the brick have been largely unsuccessful when using conventional brickmaking techniques, with the clay used in existing brickworks. Adding p.f. ash to brick clay does not alter its chemical composition to any large extent, but has a greater effect on the mineral constituents, diluting the finer clay mineral and altering the particle size gradation. This change is beneficial if the brick clay contains too much clay mineral and is consequently excessively sticky but brick clay which is mild and silty is likely to be rendered weak and friable unless highly vitrified. Results of experiments with p.f. ash as an ingredient in bricks, given in a recent paper by B. Butterworth of the B.R.S., show that local clay with which Midlands Division have been working will not satisfactorily carry more than about 25% of p.f. ash. On the other hand, a Weald clay could carry up to 40% ash, producing a brick with properties considerably improved over those made from the clay alone.

The foregoing experiments, however, being based on the incorporation of fly ash in existing brickworks, could solve only a part of the disposal problem and consequently, attention was concurrently directed to the manufacture of bricks consisting mainly of ash, particularly for stations so situated that the cost of transporting ash to suitable brickworks would be prohibitive. Attention was concentrated on bonding the ash with a small percentage of suitable clay, and then pressing the brick, using a mixture of 85% ash and 15% clay, and a press of a type design for making sand-lime bricks. Although satisfactory bricks could be produced by this method, providing the bricks were pressed twice, it was felt that plastic methods would show improvement over semi-dry pressing. Adopting this method, bricks made by extrusion and wire-cutting in the B.R.S. experimental plant were found to have a higher compressive strength and a full scale trial has been undertaken. Moreover, bricks, in the plastic state, could be both hand moulded and machine moulded satisfactorily, proving easy to dry after moulding.

The above work shows conclusively that, where a suitable plastic clay is available within reasonable distance, the manufacture of a fired brick containing some 80 to 90% of p.f. ash provides an attractive means of ash disposal. Although such bricks may not be the strongest and most dense type, as can be made using clay alone, they have properties similar to many types of brick made from clay, and, moreover, unburnt carbon in the ash assists in firing the brick, thus saving fuel.

Brickmaking, however, is not the sole means of using ash, and other work at the B.R.S. has shown that, by treating it with water in a special machine, the ash may be made into pellets. After heating to red heat, the pellets are so hardened that they are suitable for using to mix with cement to make concrete blocks not unlike breeze blocks. This development has an added importance as supplies of the clinker used up to now for breeze blocks are dwindling. Other research has also shown that up to 20% of cement in concrete may be replaced by p.f. ash.



Second Major Post-War Station in South Wales Opened

LOCATED on the Burry inlet, near Llanelly, is the Carmarthen Bay power station, officially opened last Friday by Sir Henry Self. This power project was originally inaugurated by the Carmarthen Bay Power Co., Ltd, and overall supervision of building was taken over by the South Wales Division on vesting day, the actual construction being carried out by the Civil Engineering Consultants, Balfour Beatty and Co., Ltd., who, of course, were originally responsible for both the Llanelly and District Electric Supply Co. and for the Carmarthen Bay Power Co.

The site consists of marginal coastal land, subject in places to flooding, and owing to the presence of a large derelict copper works, covered with slag deposits. Below the slag there is some 20 ft of fine brown sand and below that 40 ft of grey silty sand interlaced with clay seams. At a depth of about 65 ft, there lies a thick seam of sandstone.

Due to the low site level, extensive dewatering had to be carried out in the construction of the boiler house and turbine house basements which are 3 ft above and 12 ft below ordinance datum respectively. The dewatering system, reputed to be the largest of its kind, maintained the working conditions required to construct the deep foundations. Electric pumps ran continuously with diesel units standing by for emergency use.

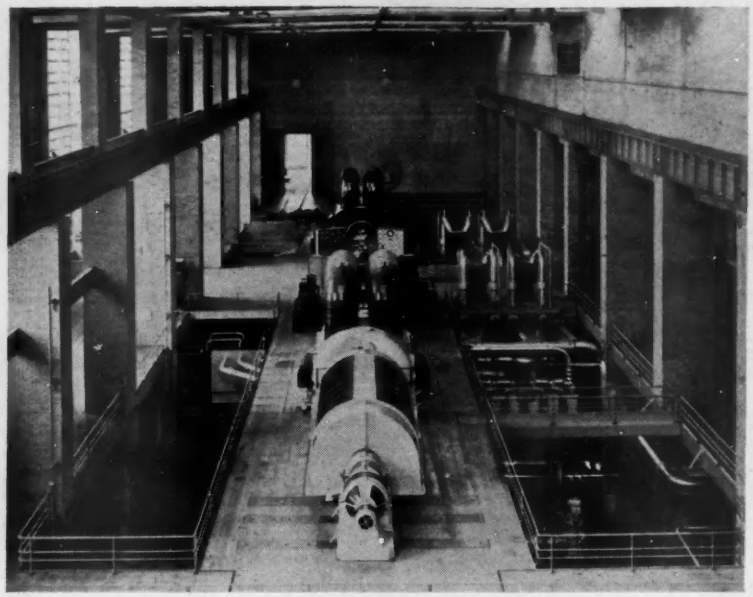
Excavation for the main building basements started in June 1948, and some 5,500 reinforced concrete piles were driven from excavation level to support the turbine house and boiler house. A further 275 box piles support ancillary buildings. By July 1953, the first 52·5 MW set was in commission and the second set followed in September. It is anticipated that by 1957 four additional 60 MW sets will be installed to bring the total capacity up to 345 MW.

Each of the three boiler houses has its own wagon discharging and conveying equipment made by Babcock and Wilcox, and this equipment is in duplicate. Each half-system can handle 75 tons of coal per hour, giving a total handling rate per boiler house of 150 tons/hr. The conveying and handling system has been completely masked. Coal is discharged from each wagon tippler (of the Rota Side type, made by Strachan and Henshaw Ltd), into a receiving hopper and fed out by duplicate electric vibrating feeders on to a 24 in. wide belt conveyor running in a tunnel under the railway sidings to the boiler house. The conveyors discharge into one or other of two encircling gravity bucket conveyors within the confines of the chimney base, which raise the coal to a sufficient height to enable it to pass through crushing and screening plant before proceeding to the boiler-house bunkers. After passing through the screens it continues down to rotary fillers, and thence to the main gravity bucket conveyors in which it is elevated and carried forward over the bunkers in the boiler house.

Boiler Plant

Each of the three boiler houses contains five Babcock and Wilcox High Head boilers, with space available for a sixth. Each boiler has an evaporative capacity of 250 klb/hr at 940 lb/sq in. 925° F, the feed temperature at the economiser inlet being 365° F. They are designed for burning semi-bituminous coal with a minimum volatile content of 13% and a maximum ash content of 15%. Pulverising is by 3 "E.44" mills per boiler, and the nine burners are of the vertical intertube type, located in an arch near the top of the furnace and firing downward. Two retractable pressure-atomising oil burners are provided for lighting-up purposes. These automatically enter through furnace ports when oil pressure is applied and are ignited by a spark from a high-tension transformer, being extinguished and retracted when the oil pressure is turned off. Babcock multiloop type superheaters are fitted with surface-type attemporators in primary and secondary stages, and provision is also made for gas bypassing. The economiser is also of the multiloop type.

Two Howden-Ljungstrom rotary air heaters are provided per boiler, and each unit has two induced draught fans with



The first two 52·5 MW sets in the station. At point of interest is the location of the control station for these two machines between their respective steam ends

an output of 62,000 cu ft/min and the two forced draught fans of 39,700 cu ft/min. In addition there are two primary air fans with a maximum output of 26,000 cu ft/min and three sealing air fans.

Automatic sequence control of the 22 soot-blowers/boiler is provided together with comprehensive instrumentation and automatic combustion control.

Turbo-Alternators

The plant already commissioned consists of two 3-cylinder Metropolitan-Vickers Electrical Co., Ltd, multi-stage impulse machines driving 52·5 MW, 3,000 r.p.m. air-cooled alternators. The remaining four sets of the same manufacture will be 60 MW hydrogen-cooled machines. Steam conditions at the turbine stop valve are 900 lb/sq in. 900° F and the condensers are designed for a 29 in. Hg vacuum with a cooling water temperature of 58° F. Twin condensers are used, the air being extracted by two three-stage steam-operated air ejectors. The condensate is then removed by vertical extraction pumps which deliver direct to the low pressure stages of the feed heating system, then through a high level full-duty type de-aerator, direct constant heater, and subsequently through the boiler feed pump to the high pressure feed heaters before final delivery to the boiler itself.

The alternators generate at 11·8 kV and the output of each is fed to a Fuller Electrical and Manufacturing Co. transformer which steps up to 132 kV.

Three electric pumps and one steam pump are supplied for working in conjunction with two turbo-alternators and five boilers. The pipework on the suction and discharge sides is so arranged that one of the electrically-driven pumps acts as a standby to each of the main electric pumps. In addition the steam driven pump can operate as a standby to any one of the electric pumps.

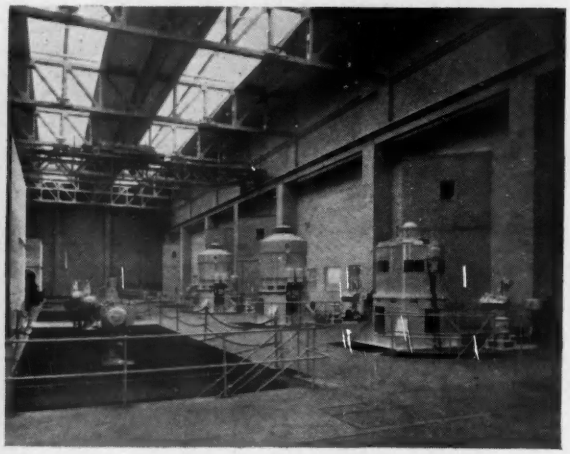
Circulating Water

As part of the initial scheme, a portion of the foreshore was reclaimed to provide a site on which the circulating water pump house would subsequently stand. A protective bund or embankment some 30 ft high by 700 ft long was constructed enclosing the site on the seaward side and forming a strong breakwater protection for the pump chamber excavations which proceeded in the land-locked area provided.

The pump house buildings above ground level are about 241 ft long by 134 ft wide by 50 ft high with foundations down to rock level. As, in the Burry estuary, there is a rise and fall of tide of 30 ft, in order to maintain the suction inlets of the pumps below water level at all states of the tide it was necessary to construct an exceptionally deep pump house.

The intake and outfall culverts for the circulating water system had also to be constructed in part of the foreshore, the bulk of work being carried out between high water

The view on the left shows the foundation work being carried out on the circulating water pump house. On the right is a part of the interior of the circulating water pump house in its present state



The main control room at Carmarthen Bay is comparatively straightforward. An interesting point, however, shown in this photograph, is the lighting arrangement

level and a level below that of low water. The work was consequently subject to most difficult conditions. Steel-sheet coffer dams were built to allow the work to proceed in sections, the excavated sand being pumped from the coffer dams on to the foreshore. The inlet culvert is about 300 ft long with an invert level 25 ft below o.d. and the discharge culvert is 560 ft long with an invert level of −20 o.d. Both culverts are constructed of reinforced concrete and a travelling shutter was used in their building. Internal cross sectional dimensions of each are 19 ft by 15 ft.

Seven vertical spindle two-stage axial flow c.w. pumps each with a capacity of 3,156,000 gallons/hr are to be installed. Each set will then be supplied with circulating water from one pump, the seventh unit being held as standby.

Main and Auxiliary Supplies

The alternators will feed into the Grid via six generator transformers, each with a no-load ratio of 11·8/141·6 kV, the first two of which will be of 63 MVA capacity with the remaining four of 72 MVA. Station auxiliary supplies are obtained from two station transformers of 10 MVA capacity with a no-load ratio of 132/3·457 kV, and from six unit transformers of 6 MVA capacity with a no-load ratio of 11·8/3·457 kV. These are all located in houses along the south side of the turbine house and are all water cooled. Generator and station transformers are fitted with on-load top-changing gear.

The unit and station transformers feed an auxiliary network at 3·3 kV and, via air-cooled auxiliary transformers of 250 and 500 kVA capacity with a no-load ratio of 3·3 kV/433 V a subsidiary 415 V system. Switchgear on the 3·3 kV system is of the air-insulated type rated at 150 MVA, while that on the 415 V system is rated at 25 MVA. In addition to these supplies, a 150 kVA emergency diesel set is included to maintain essential services in the event of a complete shutdown. Direct current for operating the switchgear, including the 132 kV system, and also emergency lighting is provided from a station battery.

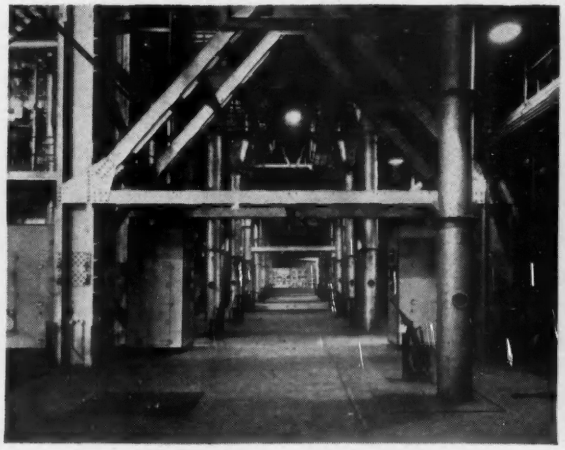
Main Switchgear

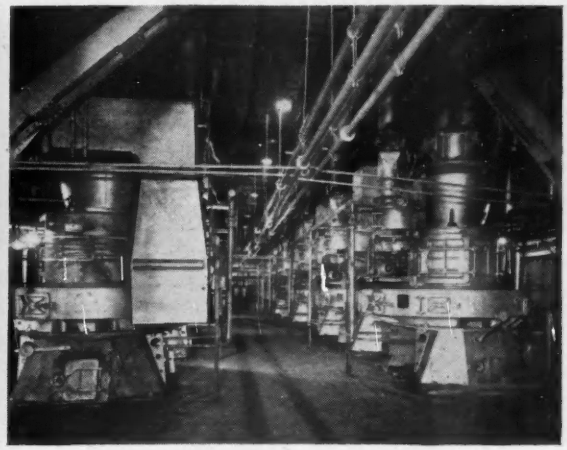
An unusual feature of the main 132 kV switchgear is that it is housed in a hall-type building which affords it complete protection from the effects of salt spray, and, at the same time gives a considerable saving in floor space.

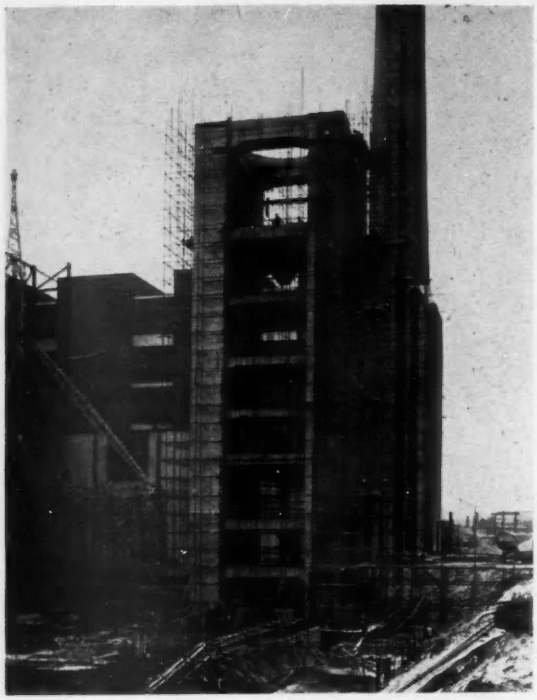
The switch house is 320 ft long by 90 ft wide by 50 ft high, and is divided into two main halls, east and west, by a central block which houses the feeder and busbar protective gear, compressed air plant, CO_2 fire fighting, low voltage a.c. and d.c. distributor boards, offices and stove accommodation, and a room for the main busbar section switch. There is a basement of cellular construction under the whole building for cables and air lines. This has 92 compartments and provides a rigid floor.

Each half of the building has accommodation for 10

One of the boiler house aisles is shown on the left. On the right is a view looking along the line of pulverising mills, of which there are three units for each boiler







Here is a view of No. 2 chimney pedestal. Much of the coal handling and preparation plant has been ingeniously concealed within this structure

circuit-breakers of Ferguson Pailin manufacture, with associated isolators and connections for a double busbar layout. The reserve bar in each half is in the form of a "U" running along the north, south, and central block walls and the two halves are coupled together via isolators and through wall bushings. The main busbar runs down the whole length of the middle of the building.

Along the north wall is provision for eight feeder and two reactor circuits, and along the south wall for six generator, two station transformer and two bus-coupler circuits. The feeders are all overhead lines, while the generator and station transformer circuits are cable-connected to their respective transformers by single-core, 132 kV, Pirelli General oil-filled cables laid direct in the ground.

The circuit-breakers themselves are of the air-blast type with two series interruptor heads per phase with a rating of 132 kV, 600 amps and a rupturing capacity of 2,500 MVA. Normal operating air pressure is 300 lb/sq in. and four 3-stage compressors operating in two banks supply air at an initial pressure of 600 lb/sq in. Each breaker is 16 ft 6 in. high, 7 ft centre to centre of phases and 27 ft centre to centre of adjacent units. The main control room for the system is in the power station proper.

Ash Disposal

Grit arresters of Prat-Daniel manufacture and Sturtevant electrostatic precipitators are fitted to each boiler, the main ash however, falls into a dry ash hopper and is discharged at intervals into sluiceways which convey it to the ash sump where it joins grit and dust from the arresters and precipitators. From the sump the ash is pumped to waste area on the east side of the station. In Nos. 2 and 3 boiler houses, water-filled ash-hoppers are to be installed.

Opening Ceremony

Sir Henry Self was introduced by the Controller of the South Wales Division, Mr H. J. Bennett, who said that over the past few years there had been a marked increase in the electrical load of South Wales.

Sir Henry pointed out that the generating capacity of South Wales had increased from 546 to 878 MW in the past six years. This represented an increase of just over 60% as compared with 50% for the rest of the country. Even so, three further high efficiency stations were also planned for future building in South Wales. These were the second 360 MW station for Uskmouth, a 120 MW plant at Rogerstone, and the proposed Aberthaw station with a capacity of 600 MW. By concentrating this amount of power in the South Wales area, it would be possible to supply the heavy industrial demand, and also assist by the Grid, electricity supply in the country as a whole.

The Carmarthen Bay station, said Sir Henry, owed its beginning to the former Llanelly and District Electric Supply Co., and although the general scheme had been vested in the Authority upon the introduction of nationalisation, association with the old company had been maintained by the retention of Balfour Beatty and Co. as civil consultants and contractors for the whole of the constructional work. Sir Henry congratulated Sir Percy Thomas, the architect, for the excellent appearance of the station.

Sir Andrew MacTaggart, chairman of Balfour Beatty and Co., proposed a vote of thanks to Sir Henry Self. He traced the long association of his company with the area. In 1910, Balfour Beatty took over the Llanelly and District Electric Supply Co., and in 1911, built the North Dock Power Station. By 1948, the load had risen to some 35 MW. The expansion of South Wales industry, however, required a much larger station, and just before the war the site of Carmarthen Bay had been selected and the Carmarthen Power Station Co. formed to undertake the work of construction.

Alderman Emrys Aubrey (Chairman of Carmarthenshire County Council) who seconded the vote of thanks, emphasised the demand for electricity in the rural areas of the country, and expressed concern at the rate of progress in this direction.

Prior to the actual opening, which was performed by Sir Henry Self who pressed a button opening the main station doors, Mr Bennett presented him with a small silver saucepan as a memento. This unusual gift was inspired by the fact that Llanelly was the centre of the tinplate industry, and the source of the well-known (to the Welsh) song "Sospan fach" or "Little saucepan"

PRINCIPAL MAIN CONTRACTORS

Civil engineering and Civil Consultants	Balfour, Beatty and Co., Ltd.
Turbo-alternators	Metropolitan-Vickers Electrical Co.
Steam-raising plant	Babcock and Wilcox.
Air-heaters	James Howden and Co.
Fans	Davidson and Co.
Dust Collectors	Prat-Daniel.
Precipitators	Sturtevant Engineering Co.
Feed Pumps	Harland Engineering Co.
Steam pipes	Stewart and Lloyds.
Evaporators	Aiton and Co.
Pumps (CW)	Vickers Armstrong Ltd.
Motors (CW)	Laurence Scott and Electromotors and British Thomson Houston.
Screens (CW)	F. W. Brackett Co.
Coal handling plant	Babcock and Wilcox.
Ash handling plant	B.V.C. Industrial Constructions Ltd.
132 kV switchgear	Ferguson Pailin Ltd.
3·3 kV and 415 V switchgear	British Thomson Houston.
Transformers	Fuller Electrical and Manufacturing Co., Ltd.
Auxiliary transformers	Hackbridge and Hewittic.
Lighting	Metropolitan-Vickers Ltd.
132 kV cables	Pirelli General Cable Works Ltd.
Other cables	Britannic Cable Co. British Insulated Callenders Cables. Hackbridge Cables Ltd. Pirelli General Cable Works, Ltd.
132 kV transmission lines	British Insulated Callender's Construction Co., Ltd.

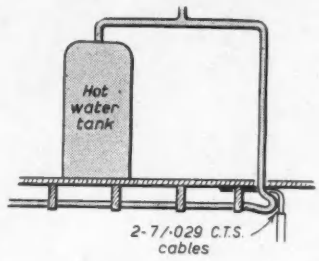
PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Heat Controlled Clock

AN electric clock was supplied via its own fused connector from a heater circuit that, in turn, had its own pair of fuses. When the clock had been found stopped at different times on three occasions and was restarted each time, enquiries were made as to the possibility of a mains failure. This possibility having been ruled out, further checking showed that the neutral fuse in the heater circuit had blown. A "Megger" insulation test of the cables from the distribution board to the heating socket gave the neutral cable down to earth.



Layout of hot water piping which expanded to contact the clock cable

Examination of the cables at the back of the dis-board and the socket disclosed nothing wrong so attention was paid to the cables running up the wall from the socket. The source of the trouble was then discovered. The cables had been clipped securely to the floor joists under the airing cupboard but no one could have foreseen that the hotwater pipe from the cylinder would expand in such a direction that it would eventually char the insulation off the phase and neutral wires without touching both together.

On one of its expanding movements the pipe must have touched the phase wire and for some unexplainable reason only the neutral fuse blew (both fuses were loaded to the same capacity). From then onwards the heater and clock circuit was maintained while the pipe remained in contact with the neutral cable and the clock stopped each time the movement was away from the wire. The pipe had expanded over three inches due to restriction in the joist, through which it passed, preventing the movement being passed on under the floor to the rest of the piping.—*H. J. W.*

"Naughty" Neutral

IT was reported that lights and electric fires in two office huts at the end of a 3-phase and neutral overhead supply line were giving cause for alarm. In one office, the lamps and fires were abnormally bright, in the other, abnormally dim. Each hut was supplied with a normal 230 V, phase/neutral, but not off the same phase. Preliminary tests with a voltmeter produced some remarkable results.

Without altering any of the sub-circuit switches in the huts, we found that, with both main s.p.n. switch fuses open, the mains voltage at the live side of the switches was normal, i.e., 230 V. When the main switch in hut "A" only was closed, we found that we had 310 V at the live side of the switch in hut "B." On reversing the scheme and testing with "B" closed, and "A" open, we found only 90 V at the live side of switch "A." Other huts, off the same phases but with only one lamp in each, gave normal voltage readings on individual tests. After considering the existing facts it was decided that the fault was in the connection to the overhead lines outside the huts. Investigation proved everything in order, so further consideration was necessary. It was then found that any alteration in the load in either hut caused a definite change in the relative voltages. This led us to the conclusion that the neutral was not all that a good neutral should be.

On checking along the overhead line, it was found that at a corner junction pole, the connection of the neutral "jumper" had, through corrosion, and probably initial bad electrical contact, become over-heated and created a badly-charred joint. This joint was apparently able to pass sufficient current for one or two lamps, but broke down as soon as a heavier load was demanded Viewed from ground level, everything seemed in order, but on closer inspection, the fault was obvious. When the faulty connection was remade everything was back to normal.

Although the cause of the trouble was simple, the symptoms were quite confusing. If the huts had not been near enough to one another to allow quick checks and comparisons, the solution might have been more difficult. The combination of parallel points in circuit in each hut provided two unequal loads in series across two phases, connected by the bad neutral line. Fortunately, the relative value of the loads was such that it did not allow the voltage to rise to a damaging level.—*W.D.M.C.*

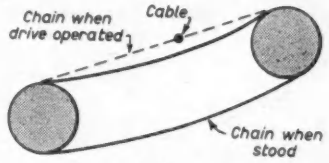
Poor Craftsmanship

RECENTLY our Street Lighting Engineer reported that on a new housing estate a number of lamps were alight and could not be switched off. The lamps in question were fed from a substation by the switchwire of a five core cable, and it was found that this switchwire was being made alive, somewhere on the system, from the blue phase.

To enable us to locate the fault, all the fuses were withdrawn from the lamps and from the houses on the blue phase. The end box was removed from the far end of the cable so that a loop resistance test could be made from both ends. From a few simple calculations, eliminating the fault resistance and taking into account the different sizes of the switch wire and phase cores, a location was made. The fault was found to be caused by a piece of tinning metal shorting across the cores in a house service tee joint—an example where careless jointing proved extremely costly, and wasted a considerable amount of time and labour.—*District Engineer.*

Chafing Chain

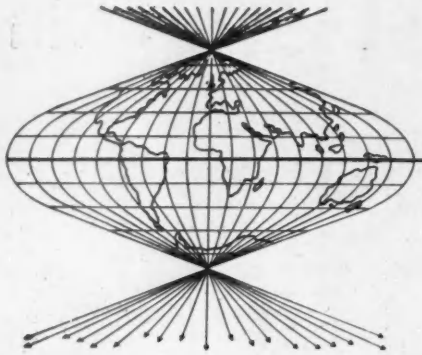
AN earth leakage meter on a large rolling mill motor starter panel was found to be giving intermittent readings. The machine was shut down and thoroughly tested for earth faults, but none could be found. A visual inspection of all likely places followed, and the fault was eventually found.



The chain, when driving, chafed the loose control cable

The motor rheostat is operated by hand through a chain drive. This is part of a driving desk for three mill motors, the chain being under the desk and boxed in. One of a bunch of control cables had come loose, and dropped into such a position that when the rheostat was operated, the slack in the chain drive became tight and rubbed against the loose cable, which it had done until the insulation was worn through.—*A. Kaye.*

Testing Relays.—We have been asked to point out that in the diagram reproduced with the article under this heading (3 Aug. issue), the common connection between the overcurrent elements in the protective relay had been omitted with the result that the earth leakage element was not shown residually connected.



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

B.C. Project

In Ottawa it has been announced that the government has granted North-West Power Industries Ltd, a subsidiary of Quebec Metallurgical Industries and Frobisher Ltd, a priority permit assuring the company first consideration in its plans for a large power development scheme for the Atlin Lake area of northern British Columbia. (We reported on 12 Aug that application had been made to the British Columbia Government for the water rights). Potential of the Yukon River watershed involved, has been estimated at well over 4 million h.p. The initial development will consist of an 880,000 h.p. hydro-electric and smelting project.

Expenditure Approved

The Saskatoon City Council has approved capital expenditure totalling $3,943,000 by the Saskatchewan Power Corporation to increase generating capacity of the Saskatoon power plant from 75 MW to 105 MW. The cost will be borne by the Power Corporation, but under the existing agreement between the city and the provincial government agency, capital expenditures on the local generating plant must be approved by the city. We reported on 15 July that the Power Corporation had placed an order with C. A. Parsons and Co., Ltd, for a new turbo-generator for the Saskatoon power station.

Sir Adam Beck Opened

The No. 2 Sir Adam Beck generating station at Niagara Falls, of the Hydro Electric Power Commission of Ontario, was formally opened last Monday by the Duchess of Kent. Full details of the station were given in our 20 May issue when we recorded that the first 100 MW set was in commission.

U.S.A.

Portable Atomic Power

The United States Army has announced that it is to construct a nuclear power plant to produce heat and power which could be taken apart and flown for quick assembly in remote places.

The working model is expected to be in operation within two or three years, and will cost about £3 millions. It will be recalled that the possibility of building an atomic power plant in Alaska was suggested some time ago.

New U.S. Vacuum Furnace

A new 1,000 lb vacuum furnace, brought into operation by the Utica Drop Forge and Tool Co., is specially designed for the high temperature melting and centrifugal casting of titanium, molybdenum and their alloys. Together with another furnace of the same size, expected to be working shortly, this new unit significantly increases the country's vacuum metal-producing capacity. Output of each furnace can be as high as 8,000 lb/day.

GREECE

Lamp Production

In Greece, the Minister of Industry has approved the establishment of a factory for the manufacture of electric lamp bulbs, electric fittings, valves, etc. by the Dutch concern, Philips. Initially, the lamp bulbs produced at the factory will have to be exported, and local sales will not be permitted until 2½ years after the start of production, we understand. Machinery, raw materials and a large part of the capital required will be provided by Philips'.

AFRICA

Victoria Falls

Concerning our note on 19 Aug., dealing with extensions to the Victoria Falls power station, we are asked to point out that no contract has yet been placed for the third pipe line which will take water to the new 3,000 kW generator now on order.

S.W. ASIA

Punjab Expansion

The Punjab Government's plan to expand the Mandi hydro-electric scheme has been approved by the Indian Planning Commission. After a thorough examination of the scheme, the Commission has agreed to its inclusion in the State's Five Year Plan and has sanctioned a Central Government loan of Rs. 35 lakhs for the current year. The total expenditure from Central and State resources is estimated at Rs. 13,000,000. The major aim of the plan is to provide power for domestic, irrigation and industrial purposes to Punjab's rural areas which are not to be covered by the Nangal project. The Mandi development scheme will thus supplement Nangal's supply system. It is proposed to lay 400 miles of lines from Dharamsala to Ludhiana serving areas in Kangra, Gurdaspur, Ambala, Ferozepur, Ludhiana, Jullundur, Gurgaon and Karnal districts.

French Electrical Goods for Pakistan

Under a new trade agreement shortly, Pakistan is to grant France most favoured nation treatment after Commonwealth countries, and those having common borders with Pakistan, it is reported. The scheme provides for special licences for French goods, including electrical equipment.

Karachi Contracts

Contracts have now been placed for much of the equipment involved in the proposed 66 kV transmission to be erected by the Karachi Electric Supply Corporation around its area, to which we referred on 29 July. The forty miles of 66 kV overhead line is to be provided by British Insulated Callender's Cables Ltd, but the contracts for five miles of 666 kV underground cable and for substation transformers have been placed with Siemens-Schuckerwerk, of Germany.

Proposals for Ceylon

Well down in the list of countries on the basis of electricity generated per head of population, Ceylon hopes to soon improve its position. The Ceylon Electrical Development Association has just presented to the Government a memorandum suggesting reductions in electricity charges which would encourage greater consumption. At present, domestic rate is 10 cents per unit for the first 100 units, 8 cents for the next 100, 7 cents for the next 500 and 6 cents for all over 700 units. The Association suggests a charge of 10 cents for the first 50 units and 6 cents per unit for all in excess, which, to most consumers would amount to a reduction of about 20%. In regard to the hydro-electric projects, the Association also suggests that the capital costs could be reduced. The Norton Bridge scheme, it says, is a limousine plan, to be carried out with bullock-cart finances. It maintains that treated wooden poles would suffice for transmission lines instead of expensive steel structures.

AUSTRALIA

Another H.E. Scheme

Apart from the immense Snowy Mountains hydro-electric scheme being built in New South Wales, there is another water power project under construction in the State. This is situated on the Oakey River, about 30 miles east of Armidale, and is being undertaken by the New England County Council. Estimated annual output of this scheme is 10 million units. Expenditure up to the end of December last amounted to £320,000. It is hoped that the 20,000 kW plant will be in operation about the middle of next year. The power house is being built in a 1,000 ft gorge. It is expected that the new power supply will facilitate rural electrification in the area, and will meet the demand for the next few years.

Power Link?

The State Electricity Commission of Queensland is considering the possibility of constructing a connecting line between the proposed Tully Falls power house and the Townsville power system. The Tully Falls station is intended primarily to supply the Cairns district, but it is suggested that a link with the Townsville system would mean lower coal charges to the latter area with a consequent saving for consumers. The Tully Falls hydro-electric scheme is expected to be in operation in the second half of next year, and it will eventually have four 18,000 kW generators.

Electronic Research

Latest British company to set up a private research laboratory at the Long Range Weapons Establishment in Australia is the General Electric Co. The laboratory, which will conduct research on electronic equipment associated with guided missiles, is to have as its superintendent Mr R. G. Birch, who arrived in Adelaide recently to organise preparations for the new laboratory.

NEW ZEALAND

Expansion Proposals

Measures to provide for future power demands in Tauranga, North Island, N.Z., have been recommended by the electrical engineer, Mr C. W. Boak. The borough council has two hydro-electric stations, at McLaren's Falls and Omanawa Falls, and there is interconnection with the North Island undertaking of the State Hydro-Electric Department. Mr Boak estimates that the two power stations will reach full capacity by 1959. He suggests duplication of the main transmission line from the borough's own plants, at a cost of £9,687, and the installation of a control system for hot water services, to cost £27,000. He rejects as uneconomic, proposals for the construction of a further generating station a mile below the present power house at McLaren's Falls. The Council's electricity committee is to consider the recommendations.

H.E. Dept's Good Year

For the year ended 31 Mar. last, the New Zealand State Hydro-Electric Department had a surplus of £2,202,795, after charging interest and depreciation. This high figure has been largely attributed to the abnormal hydraulic conditions last year and the comparatively small use of steam power stations. The report of the general manager of the department, Mr A. E. Davenport, sets last year's revenue at £382,000 more than budgeted for, because of increased sales at the higher price. Heavy rains came at critical times. It was possible to shut down the thermal generating stations at King's Wharf and Evans Bay. The total savings for New Zealand on fuel generation and purchase of bulk power amounted to some £542,000. Power generated during the year increased by 15·4% in the North Island and by 6·8% and 8·6% in the two areas of the South Island. The report shows that the department has £99,563,589 invested. Works under construction, survey and investigation and plant cover some £34 m. Last year's capital expenditure totalled over £14 m.

Power Shortage again

With a serious depletion of water storage on the South Island during the past weeks, the New Zealand State Hydro-Electric Department has had to ask the supply authorities to restrict power consumption. In most areas, it seems, consumption has been about 5% to 8% above the allocation, and a number of authorities, including Dunedin and Christchurch, have had to introduce power cuts and restrictions on the use of electricity for water heating between 7 a.m. and 2 p.m., for radiators between 10 a.m. and 2 p.m., and for signs. Cold weather in the North Island has also resulted in record peak load figures there—645,500 kW having been recorded on one day.

FAR EAST

Station for Luzon

The Swedish firm, Widmark and Platzer, has been awarded a contract by the Philippine State for the construction of an underground power station. This station, which is to have an installed capacity of 75,000 kW, will be built near Baguio city, on Luzon Island. Value of the contract has been put at 30 million Swedish crowns.

Loan for Development

Japan's Foreign Investment Council has approved the Tokyo Power Co.'s application to obtain a $9,989,000 loan from the International General Electric Co., it is reported. The loan will be spent in purchasing a 125,000 kW generator to be installed at a power station which will be built in Chiba Prefecture by Dec., 1956. Of the total loan, 25% which is free from interest will be paid back in four instalments up to 1 Nov., 1955. The remaining 75% will be repaid every three months in 21 instalments from 1 Dec., 1956, to 1 Dec., 1961.

Believing that the development and intelligent use of electrical appliances is a necessary complement to the Supply Industry, the Auckland Electric Power Board, New Zealand, has recently expanded the facilities at its Homecraft Advisory Centre and Demonstration Room, shown on the right. Apart from the usual demonstrations, the Centre is conducting a series of lessons in homecraft and elementary cooking, held at the Centre itself. There are two classes, each for six students, on one morning a week for six weeks. It will be seen from our photograph that each participant has an individual pastry table with full equipment for putting into practice the instruction given. Tuition and ingredients are free, and articles may be purchased by the class. Mr N. M. Speer, the Board's general manager, tells us that the classes are extremely popular. It is not surprising that the Board is connecting over 3,000 electric cookers each year—it already supplies over 80,000 domestic consumers of whom nearly 50,000 cook by electricity

Personalities

IN THE INDUSTRY

Two officials of the Johannesburg City Council are coming to Britain in connection with the placing of orders for new plant for the extension of the Kelvin power station. They are **Mr J. C. Fraser** M.I.MECH.E., M.I.E.E., M.(S.A.)I.E.E., the general manager of the city Electrical Department, and **Dr I. Q. Holmes**, the city treasurer. They are due to arrive in Britain on 24 Sept, and it is expected that their visit will occupy several weeks. The new proposed extension to the Kelvin power station will consist of three 30 MW turbo-alternators together with associated boiler plant, scheduled for operation in 1959-60. The consulting engineers for the project are Merz and McLellan.

The Council of the British Institution of Radio Engineers has announced that **Rear-Admiral Sir Philip Clarke,** K.B.E., C.B., D.S.O., is to be the next President of the Institution. He is director of the Naval Electrical Department.

District commercial officer at Southport to the Merseyside and North Wales Electricity Board, **Mr S. Fairclough,** A.M.I.E.E., will shortly take up a new appointment with that Board as second development assistant (industrial), No. 1 sub-area, operating from the sub-area headquarters at 24 Hatton Garden, Liverpool.

To succeed **Mr J. H. Davies,** who is retiring in October from the position of district manager at Banbury, to the Midlands Electricity Board, **Mr H. Eagles,** B.SC (ENG.), A.M.I.E.E., has been appointed to that post. Mr Eagles is at present district commercial engineer at Mexborough to the Yorkshire Electricity Board. Prior to nationalisation of the Supply Industry, he was electrical engineer and manager to the Mexborough U.D.C., after being engineer and manager of the Adwick-le-Street U.D.C. electricity undertaking for two years, and holding a similar position with the Ashbourne U.D.C. from 1941 to 1946. Earlier, he had spent periods as assistant mains engineer at Aylesbury and with the Mid-Southern Utility Co., West Cambrian Power Co., and the Wigan Corporation Electricity Department.

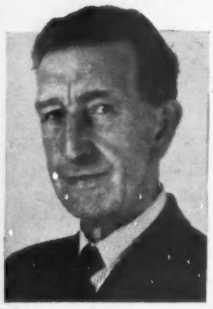
At present North Wirral district commercial officer to the Merseyside and North Wales Electricity Board, **Mr J. L. Carson,** B.SC., A.M.I.E.E., is relinquishing that position at the end of this month to take up the post of district manager at Bromsgrove, with the Midlands Electricity Board. There he will succeed **Mr E. B. Willis,** ASSOC.I.E.E., who is going to Kidderminster as district manager to the Midlands Board. Mr Willis was assistant district manager at Kidderminster from 1946 to 1948, and became district manager at Bromsgrove in Aug. 1948.

The L.P.S. Electrical Co., Ltd, have appointed **Mr J. P. Abbott** as their outdoor representative covering the London area. He has been with the Telegraph Construction and Maintenance Co., Ltd, for over 20 years, and for the past 2 or 3 years, their outdoor sales representative. The L.P.S. Co. has also appointed **Mr D. Prior,** of 27 Livingstone Rd, Pokesdown, Bournemouth, as their outdoor representative covering the Southern counties area. He has had experience with Pirelli General Cable Works, of Southampton.

At the end of October next, **Mr S. M. Hill,** M.I.MECH.E., F.INST.F., will relinquish his present appointment as generation engineer (operation) with the South Western Division of the B.E.A., following a period of extended service beyond his retiring age. Mr Hill's association with the Division will not be severed, as he will continue for a time in a consultative capacity on operational matters associated with the construction of the Portishead "B" power station. **Mr P. L. Lutte,** who is at present generation engineer (operation) at Plymouth, in charge of the Division's southern group of stations, will transfer to the northern area, and will take up his duties there on 1 Nov. Prior to nationalisation of the industry, Mr Lutte was station superintendent at Earley power station. Mr Hill, who has held his present position since vesting day, has had a long association with the Portishead power station—he was station superintendent there from 1929 to 1948. He went to Portishead following ten years' service with the Lancashire Electric Power Co., and earlier, spent short periods of service with Birmingham and Norwich Corporations.

Mr H. Eagles

Mr P. L. Lutte



Mr A. Phillips

Sir Claude D. Gibb, chairman and managing director of C. A. Parsons and Co., Ltd., has left England on a six weeks' visit to Canada, the United States and Australia. Sir Claude will attend the conference at Philadelphia, as one of the British delegates, of the International Electrotechnical Commission. On 27 Sept. he will attend the official opening of Messrs Parsons' new works at Whyalla, South Australia. The new factory will be opened by the Prime Minister of South Australia, Rt Hon. Thomas Playford.

Administrative officer at British Electricity Authority administrative headquarters in London, **Mr J. C. Ingram,** M.A., has been appointed secretary to the West Midlands Gas Board.

The Minister of Fuel and Power has appointed **Councillor J. Atkinson,** M.B.E., J.P., M.SC., A.R.I.C., of Chinley, Stockport, and **Councillor A. W. Berry** of Littleborough, Lancashire, as members of the North Western Electricity Consultative Council.

One of the Vacuum Oil Co.'s industrial salesmen, **Mr H. W. Perryman,** has completed forty years' service. To mark the occasion, **Mr H. W. Rocke,** managing director of the company, presented him with a gold watch on behalf of the board of directors.

After 34 years' service with the Northmet Co., and Eastern Electricity Board, **Mr A. Phillips,** district commercial engineer at Enfield, retired on 31 Aug. He went to Enfield as sales engineer in July 1920, shortly after demobilisation from the Army. He started his career with the Twickenham and Teddington Electric Supply Co., at Teddington, in Nov. 1903, leaving there as shift engineer in July 1913, to take up an appointment with the Croydon Corporation as assistant consumers engineer. In

Jan. 1914, he joined the Cornwall Electric Power Co., at Carn Brea as assistant engineer, and early in 1915 enlisted in the Cornwall Fortress R.E. Searchlight Co., at Falmouth, serving for about 4 years in France.

Managing director of the Ductube Co. Ltd., **Mr B. V. Cufflin,** returned last week-end from three weeks business tour of Portugal, Germany, Holland and Belgium.

OBITUARY

Mr A. J. Cridge, M.I.E.E., who died on 21 Aug., aged 72, served with B.E.A.M.A. from 1930 until retiring in 1950, chiefly as a committee secretary. Educated at Westminster City School, Finsbury Technical College and Sheffield University, he gained early experience with the Brighton Corporation Electricity Department, and in 1900 he became superintendent of the meter and general testing department at Sheffield. In 1915 he joined the former British Westinghouse Co. as manager of transformer sales, and in 1922 went to the Brush Electrical Engineering Co. as transformer sales engineer. From 1924 until 1930 he was assistant general sales manager of Johnson and Phillips Ltd.

Mr T. M. Buist, late chief installation inspector in Edinburgh Electricity Department, died on 24 Aug.

Mr M. M. Andrews, third assistant district engineer at Luton to the Eastern Electricity Board, was electrocuted on 24 Aug., while investigating a fault at a Leighton Buzzard substation.

Col. H. B. Sankey, chairman and, latterly, managing director of Joseph Sankey and Sons, Ltd., and a director of Guest, Keen and Nettlefolds Ltd., died on 27 Aug., aged 59. He joined Sankey's in 1921; became managing director in 1935, and chairman of the company in 1951.

Sir Henry Steward, T.D., who died on 28 Aug., aged 89, was for many years prominent in technical educational circles. He was a governor of the Northampton Polytechnic, vice-president of the City and Guilds Institute in 1950, vice-president of the Royal Society of Arts from 1938 to 1942, president of the Union of Educational Institutions from 1938 to 1943, and of the Association of Technical Institutions from 1939 to 1943. He was elected a fellow of the Imperial College of Science and Technology in 1950.

Mr A. E. Evans, a former secretary of W. Canning and Co., Ltd., died on 25 Aug., aged 86.

NEW LITERATURE

Electricity on the Farm

FARMERS will be especially pleased with this book, which deals with the many uses on farms to which electricity may be put. Commencing with a chapter on the economics of electricity supply, and notes on the amount of work a unit of electricity will do around the farm, there follow chapters on lighting and water supply. Recommended illumination values are given for various tasks and buildings and the advantages of a pressure-boosted water supply are explained. Electric motors are then presented as a means of obtaining economical drives, illustrations show various applications, and notes are included to enable correct selection of size and type of motor to be made.

Barn-hay, grain and in-silo drying are included in a chapter which deals with the electrical drying of crops; systems employing combinations of fans and heaters being described. The application of electricity to milk, poultry and egg production is then discussed in detail. A chapter on pig-rearing discusses the use of floor warming and creep-heating devices, infra-red heating and electrically-heated milk for piglets is followed by an account on uses of electricity in farm houses, and correct installation methods.

The book is intended for use by farmers and their electrical advisers in the Area Boards. At all times it avoids complication, and makes easy reading for the non-technical man. Published by the British Electrical Development Association, 2 Savoy Hill, W.C.2, 100 pages, 8½ in. by 5½ in. Gratis.

Electrical Ignition Systems

by F. G. Spreadbury, M.A.I.E.E.

ABSOLUTE reliability is a "must" for modern petrol engines, whether they be for use in aircraft or automobiles and it follows that since these engines rely on the electrical ignition system to produce the sparks, the quality and performance of this equipment shall be of the highest order. Unfortunately for the electrical equipment, it usually operates under the most unsatisfactory conditions being subject to constant vibration and heat. This factor, coupled with the normal terms of its specification, which state that the equipment shall be as robust, compact and light in weight as possible has necessitated considerable research. The book is concerned with the theory of ignition, the design considerations involved in manufacture of suitable apparatus, and the practical testing of various components in an ignition circuit. Before launching into the main theme, the author tells a little of the early ignition systems, mentioning the "hot-tube" method, which will stir the hearts of veteran car fans, and he traces the history of ignition systems since their inception. Then follow, a chapter devoted to the nature of sparks and the design of sparking plugs—this is developed up to the stage of describing plugs used in jet engines—and chapters on ignition coils and magnetos. The investigation into each of these components is detailed, supported by graphs, illustrations and mathematical analysis. All aspects are covered including the ancillary gear such as contact breakers and distributors. The final chapters dealing with construction and design of ignition systems and testing ignition complete this excellent book, which should find its way to many engineer's bookshelves. Published by Constable and Co., Ltd., 227 pages 8¼ in. by 5¼ in. Price 25s.

BOOKS RECEIVED

The Oscilloscope at Work, by A. Haas and R. W. Hallows. Practical guide to applications of the oscilloscope, having special reference to radio and television work. Published for the "Wireless World" by Iliffe and Sons, 171 pages, 8½ in. by 5½ in. Price 15s.

Questions and Answers on Distribution and Use of Electric Power, by T. H. Carr. For power and sales engineers, dealing with problems of maintenance, construction, and operation, or users' enquiries. Published by Newnes, 112 pages, 6¼ in. by 4 in. Price 6s.

Questions and Answers on Power Station Practice and Plant, by T. H. Carr. Provides concise information on electricity supply, including organisation, legal, technical and economic problems. Published by Newnes, 128 pages, 6¼ in. by 4 in. Price 6s.

Electric Accumulators, edited by B. E. Jones. Describes, on a practical basis, construction, management and charging, being part of publisher's "Work Handbooks" series. Published by Cassell, 158 pages, 7¼ in. by 4¾ in. Price 4s. 6d.

Electric Light and Power Installations, by E. T. Lawson Helme. One of publisher's "Work Handbooks," giving instruction and advice for younger members in the industry. Published by Cassell, 176 pages, 7¼ in. by 4¾ in. Price 4s. 6d.

Electrical Measuring Instrument Practice, by Major E. H. W. Banner. Objective emphasis, covering practical scope of electrical measuring instruments for users. Published by United Trade Press, Boswell Hse. 9 Gough Sq. E.C.4, 150 pages, 8½ in. by 5½ in. Price 15s.

Automatic Voltage Regulators and Stabilisers, by G. N. Patchett. Covers principles of operation and constructional details of a wide range of automatic voltage regulators. Published by Pitman, 335 pages, 8½ in. by 5½ in. Price 50s.

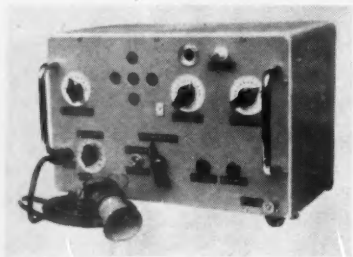
Equipment for Industry

Switchgear Service Handbook

READERS will recall that in our issue dated 27 May, 1954, we described a new oil-switch type I.C.27, manufactured by A. REYROLLE AND CO., LTD., Hebburn, Co. Durham. This switch, rated 400A and tested for making on to a fault of 250 MVA rupturing capacity at 11 kV, was of the horizontal draw-out type suitable for lining up with the firm's class "C" range of switchgear. Now introduced for the users of this switchgear, a new handbook (I.O.M.S. No. 422/7-54) issued by the firm, deals with the installation, operation and maintenance recommendations for the I.C.27. Amply illustrated and written in clear style it should prove of value to all engineers associated with this equipment.

Portable Transmitter-Receiver

SPECIALLY designed for industrial use, being light in weight, compact and robust, a new transceiver developed and produced by VENNER ELECTRONICS LTD., New Malden, Surrey, comprises a combined transmitter and receiver. The unit is said to be capable of transmitting with a useful range of 5 miles when used with an antenna of approximately 50 ft length. Entirely self contained, the electrical supply is obtained from dry batteries mounted within the case. A hand microphone with combined press-switch is used for transmission and signals are received either from headphones or from a loudspeaker. Normal conversation level gives adequate modulation. One of the first uses to which these transceivers will be put is for intercommunication on the Dutch canal barge system.

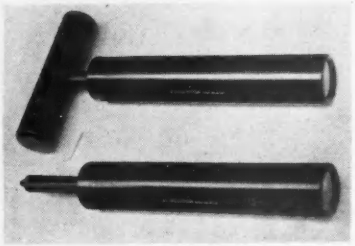


The new transceiver combines light weight with robustness and is easily transportable

Detecting Live Lines

THE advantages of being able to test whether a conductor is energised without making actual physical contact are at once apparent. An instrument, which makes this possible, is being produced by HIVOLT LTD., 34a Potters Lane, Portland Rd, W.11, and operates from the electrostatic field surrounding a current carrying conductor. It therefore cannot be used on power cables which have a metal sheath casing. Otherwise it is claimed to be suitable for use on systems of any voltage, the range quoted being from 50 V up to 132 kV, and some of these instruments have already been sold to the British Electrical Authority and various Electricity Boards. Duties envisaged for the instrument, in addition to that quoted, are fault testing and for testing the busbars in metalclad switchgear. When being used for the latter service, a special cross-member is mounted at right angles to the body of the instrument and is so designed to prevent access to the spouts to the extent that contact could be made with them.

The main body of the instrument contains the meter—the deflection of the pointer gives indication of current flow—components, and switches, all these being contained within a polished ebonite sleeve. A probe, which screws onto the main body of the instrument is used for the normal duty. These two main components together with the cross-member are contained in a leather carrying case. The weight of the instrument is 2 lb and the length is 16½ in. including probe.



The instrument is shown here with, above, cross member connected

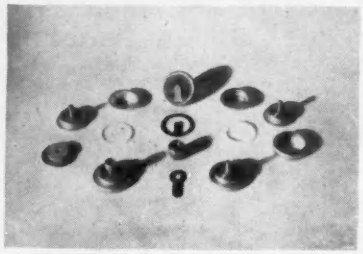
General Purpose Resin Adhesive

ALMOST a "universal glue" is the claim made by LEICESTER, LOVELL AND CO. LTD., North Baddesley, Southampton, for their latest product Epothen M777 in the epoxide resin range. Capable of bonding without pressure materials such as leather, plastics, metal, wood and glass, the resin may be used for a wide variety of applications. With fillers the resin can be used for castings up to ½ ton, and has proved so hard, tough and stable, that it has been used in place of metal tools for pressing sheet steel.

Another of the most important applications has been for the production of accurate foundry patterns; in this case the resin is cast cold in plaster. In anticipation of demands from small industrial users, the firm are producing sample test kits containing small quantities of resin, catalyst and filler, together with instructions for their use.

Tantalum Electrolytic Capacitors

FOR use in radio or electronic equipment, the new "Castanet" tantalum electrolytic capacitors being manufactured by THE PLESSEY CO., LTD., Ilford, Essex, combine high capacitance (55 mfd) with small size, the diameter being 22 mm. and depth to 6 mm. With a working voltage of 70 V d.c., the capacitors will stand a ripple voltage of 10%, the peak ripple being 80 V and surge rating 100 V. The capacitors are claimed to operate satisfactorily in temperatures ranging from −60° C. to +150° C. Other features include a low leakage current—this is claimed to be 1 microamp at normal temperatures—and a lack of deterioration which enables them to be stored indefinitely. Single units are supplied with a soldering tag and mounting stud. Alternatively, a number of capacitors may be stacked in series or parallel to provide a higher working voltage or different capacitance.



Component parts and complete assembly of tantalum capacitors are shown here

Cyclone Dust Collector

SUITABLE for use in any application where the extraction of dust from the atmosphere is of primary importance, "Tubix" multi-cyclone dust collectors manufactured by THERMIX INDUSTRIES LTD., 29 Grosvenor Place, S.W.1, are already being used in collieries and cement works and on boilers. The method employed separates the dust into two grades, heavy and light. Due to their velocity and weight the heavier particles in the dust-laden atmosphere are separated and fall into the main hopper before the entrances to the cyclones are reached. Lighter particles are separated by centrifugal force, due to the helical motion of the atmosphere as it passes through the cyclones. These particles then are collected in a separate hopper. Main advantages over other types of collector, claimed for the "Tubix" are that the coarser and more abrasive particles do not enter the cyclone enabling them to cause undue wear and recovery efficiency is high with low velocity of air-stream.

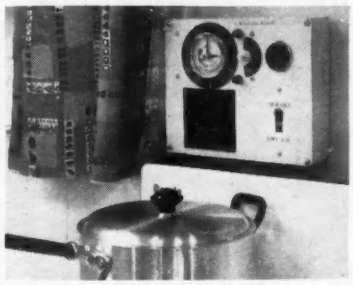
The Trojan Peeler by Crypto

THE "Trojan" potato peeler introduced recently by CRYPTO LTD., North Circular Rd, N.W.10, embodies a "close mesh" abrasive prepared from a mixture of carborundum and bakelite cement which is baked on to the walls of the peeling chambers and on the peeling plate. This feature not only makes for quicker peeling but provides an important characteristic—a minimum loss of weight. For a 7/10 lb peeler it is compact in size, height 17¼ in., length 24¾ in., width 16 in. Its weight is 142 lb. Ease of access has been well studied, the ¼ h.p. motor is enclosed by a cast iron cover released by one thumbscrew; lifting hooks are provided for the removal of the peeling plate; the door handle has a simple up and down movement but automatically provides a water tight closure

Reduced loss in weight of potatoes is noticeable in the use of the Trojan

Auto Cooking Control Unit

A NEW Time Control Unit which can be pre-set to enable any existing make of electric cooker to operate automatically within 12 hours of setting, and then switch off after the desired cooking period, has just been marketed by METALFORM LTD., 258 Gray's Inn Rd, W.C.1, and retails at £7. 10s.

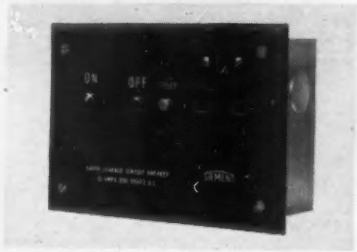


This new unit helps to bring up to date older cookers

The unit, which comprises an ordinary electric clock with a time-switch mechanism, is housed in an attractive brown and cream stove-enamelled box supplied for either flush or surface wall mounting. When not required the timing mechanism can be cut out and the cooker controlled in the usual way by means of the isolator switch fitted to the unit. A red signal lamp lights when the cooker is in use. A 13-amp socket outlet with a fused switch plug for an electric kettle is provided.

Siemens Safetrip e.l.p. Device

THE "Safetrip," latest addition to the range of earth leakage protective devices, by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38-39 Upper Thames St, E.C.4, consists of a 15-amp double-pole earth leakage circuit-breaker controlling a 13 amp shuttered socket-outlet.



Siemens Safetrip unit

Complying with B.S. 842 and B.S. 1363, it can be supplied for either flush or surface mounting and operation of the circuit-breaker is by means of "On" and "Off" push buttons. A "Test" button is also provided for electrically tripping the breaker. Giving protection against shock on sub-circuits, the breaker is eminently suitable for portable appliances and any apparatus consuming up to 3 kW.

The "Safetrip" switch socket measures 5 3/16 in. by 3 7/16 in. by 1 13/16 in. overall, and has a moulded "Bakelite" face plate behind which is mounted the totally enclosed switch mechanism and socket-outlet. Also available as a separate unit without the shuttered socket, the "Safetrip" can in this form be used with existing sockets already installed or as a safety control switch.

Errata

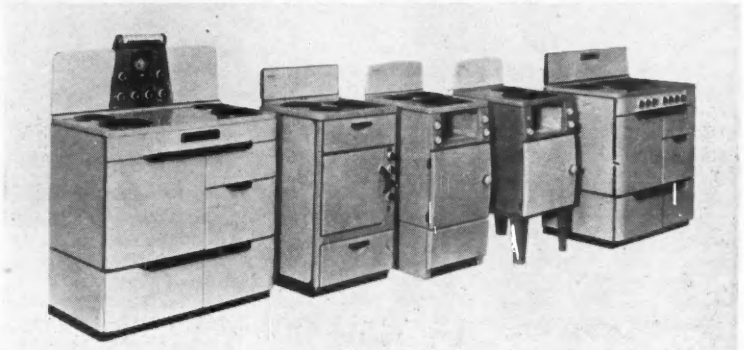
IN our issue of 19 Aug., the caption to the illustration of Reeves' new season's fires is in error. This should read "Reeves Minor and Adjustable (right)." A further error appeared in our issue of 26 Aug. on page 303. The sentence commencing just underneath the illustration of Eleco's new type "Perspex" fittings should read "This type of fitting has a light *output* ratio some 10-15% higher than .... reflectors." The exterior finish of the body is aluminium, not enamelled as stated.

For the Electrical Trade

Comprehensive Creda Cooker Range

PUBLICITY by SIMPLEX ELECTRIC CO., LTD., Broadwell Oldbury, is now featuring the comprehensive range of electric cookers they have produced. For all tastes, purposes and pockets Creda produce the "Star" 305 at £25.10s., the "Star 310" at £27. 10s., the E.V.13 at £34. 12s., and the Comets DH1 at £70. 7s., DH2 (with storage cabinet) at £78. 15s. and DH4 (4 radiant plates). Readers will be familiar with the foregoing which have been described in these columns but the latest DH6 Super Comet is the cooker par excellence. Priced £115. 10s., this cooker is really "super." It has a large hot-plate with four radiant plates with adequate free working space in the middle giving access to the control panel, large extra width oven, separate grill chamber, large warming drawer and storage space at the base. The control panel with its time control mechanism and hob light has eight control switches all backed by signal lights. The six control dials have a special "traffic signal" system of warning lights. When switched on they show blue, switch turned for more heat shows an amber light and at full heat a red light appears: thus the housewife is able to see at a glance what is in use and at what temperature.

The Creda range from "Star" to "Super Comet" is truly sparkling galaxy



NEWS OF THE WEEK

Hire Purchase Agreement in Eire

E.S.B. and Retailers Co-operate to Sell More Appliances

A NEW level of co-operation between the national electricity supply authority and private retailers has been reached in Eire. Following several months of negotiations between the Electricity Supply Board and the Society of Irish Electrical Traders, the former's hire purchase facilities have been extended to members of the Society. An announcement that such a decision had been taken appeared in the Board's annual report issued last week, and the conclusion of the agreement was announced by the Society's secretary last Wednesday. Under the agreement members will be able to sell appliances on a hire purchase basis and the collection of instalments will be carried out by E.S.B. who in turn will pay the contractor. The repayments will be made with the normal bi-monthly account for electricity consumed. An important aspect is that only a 4% H.P. price is added to the cash price, which is substantially lower than the percentages charged by finance companies.

The only limitations to the scheme appear to be those which stipulate the competence of the contractor to service the appliances sold. This new scheme will undoubtedly help the retailers who have often complained of unfair competition where hire purchase facilities are concerned, whilst the Electricity Board will not find the arrangements an encumbrance by any means, because the more appliances sold (even if not by the Board themselves) means more power consumed in the home.

Electrical Show in Montreal Next Month

THE opportunity to advertise electrical commodities in Eastern Canada occurs with the All-Electrical Show which is to be held in the Show-Mart Bldg, Berri Sq, Montreal, between 6 and 10 Oct. We understand that last year although there were a few manufacturers exhibiting industrial equipment, the emphasis was on products of direct appeal to the public. Information concerning next month's display is that exhibits will include cables, wire, wiring devices, conduits, insulation, transformers, motors, instruments, and power tools. There will also be lamps, domestic appliances, radio and TV sets, etc. Space will be sold in units of 100 sq ft at $1.75 per sq ft, and the right to exhibit is restricted to manufacturers and agents only. Applications should be made to Eastern Canada Exhibitions Inc, 423 Ontario E, Montreal.

TRINIDAD TRADE FAIR

ANOTHER exhibition, recommended by the U.K. Trade Commissioner at Port of Spain to U.K. firms with agents on the spot, is a Trade Fair to be held at Port of Spain between 1 and 17 Oct. The organiser, Mr Conrad Gonzales, arranged a similar exhibition in 1949 which proved most successful. Britain was well represented in the trade sections and over 100,000 people saw the displays. Those interested are advised to contact the Trinidad Trade Fair at Box 303, Port of Spain.

NEW HIRE PURCHASE ACT IS NOW LAW

THE Hire Purchase Act 1954 came into force in England and Wales on Monday. It received the Royal Assent at the end of the last Parliamentary session. The purpose of the Act was to extend the application of the 1938 Act and make further provisions concerning postponed orders for specific delivery of goods. The safeguards afforded to purchasers now extend to goods up to a value of £300 instead of the previous figure of £100.

This Act does not apply to Northern Ireland but latest reports from Belfast suggest that the law is likely to be amended there to follow the lead given in Westminster. The Ministry of Commerce has asked the N.I. Retail House Furnishers Association for its observations on the workings of the existing Act and on the possibility of amending it to bring it into line with England. The Association appears to favour amendment.

Advancing the Power Engineers' Claim

FURTHER discussion recently took place between representatives of the Electricity Boards and the Action Committee of the Electrical Power Engineers Association concerning the latter's claim for improved status and salaries. We understand that figures were tentatively agreed to form the base and upper limit of a new National Joint Board salary schedule, and a further informal meeting is to be held shortly in an effort to agree upon a progressive schedule between these new figures. Mr H. Norton, general secretary of the Association, reports that there is now reasonable prospect that a satisfactory settlement will result.

More Electrical Contracts at Home and Overseas

LAST week we reported a number of large export contracts secured by British manufacturers, but news of orders received both from overseas and home customers continues to come in. A contract for diesel engine electrical generating sets and spare parts has been signed by R. A. Lister and Co., Ltd, and the Signal Division of the U.S. Army in Europe. This is the second contract of the kind obtained by the company from the same source and is valued at £285,000. Venner Ltd recently received an order for 25,000 electro-mechanical instruments valued at £180,000 from the Victoria (Australia) State Electricity Commission. The contract was obtained through the Venner agents, H. Rowe and Co. (Pty.), and is claimed to be the largest single order for small precision instruments received by a European manufacturer.

Here at home, we note that Richard Thomas and Baldwins Ltd have entrusted the General Electric Co. with a £238,000 contract for electrical plant and equipment required at the Ebbw Vale Steelworks. It covers two 3,000 h.p. and 750 h.p. twin armature d.c. motors, a six-machine motor generator set driven by a 9,000 h.p. 11 kV synchronous motor and all associated a.c. and d.c. switchgear etc. Plant for the original mill was supplied by the G.E.C. in 1938.

U.K. Lamp Firm Forms Australian Company

ANOTHER British company has registered a subsidiary company in Australia, it was reported last week. Thorn Electrical Industries Ltd. has formed a £250,000 company in Victoria. It will be known as Thorn Electrical Industries (Australia) Ltd., and it is planned to make incandescent light globes, fluorescent lamps, radio and TV receivers.

Another Step towards Liverpool's Smokeless Zone

REPORTS from Liverpool confidently predict a Parliamentary Bill to establish a smokeless zone in the city centre is to be sponsored by the council after the summer recess. The proposals have been held in abeyance for some time now, but at the last council meeting the promise of a Bill was given. Latest information is that a report on the proposed zone has been prepared by the Health Committee and submitted to the Town Clerk.

Surveys of two suggested smokeless zones have been carried out. The first consisted of about 100 acres, occupied mainly by shops and offices, and bounded by Chapel, Tithebarn, Manchester, Lord and James Sts. Two-thirds of this area is already smokeless but the remainder of the premises cause serious pollution, it is stated. Old-fashioned open office fires were blamed. The second area, about 85 acres, is bounded by William Brown, Lime, Ranelagh and Hanover Sts, and the Strand, and adjoins the first. It is expected that both areas will be suggested as one in the Parliamentary Bill. Critics of the scheme point out that the proposed zone is ringed by three main-line railway stations, rendering such action almost useless. Its supporters however, maintain that a start has to be made somewhere and point to Manchester as an example of what can be done.

Post Office Engineers' Wage Claim

DISSATISFIED with the delay in dealing with the wage claim for its 58,000 members, the Post Office Engineering Union has this week opened a series of mass meetings for its members to report on the wage negotiations which began eight months ago. The increases claimed vary according to grade from about 10s. to about £2 per week. The original claim was rejected in June by the Postmaster-General, and the Union immediately submitted an interim claim for a 6% increase all round in existing scales. The Union considers this latter claim is "perfectly straightforward," but so far there has not been any real discussion on it with the Post Office.

UV Ray Experiments in Schools not Justified

THE use of Ultra-Violet rays to reduce illness in schools was not justified by the results of tests made in primary schools at Southall, Middlesex, a report of the Medical Research Council, published last week, concludes. For the purpose of those tests all the classrooms and assembly halls were equipped with ultra-violet lamps to irradiate the air in the upper part of the rooms. It was found that there was no appreciable effect on the total sickness rate, although examination of individual causes of absence suggested a reduction in the number of absences due to certain diseases. The report pointed out that the child normally spends only a quarter of his time in the treated environment. Lamps used in the experiment were by British Thomson-Houston Co., Ltd.

Nine Architects will turn "Gaiety" into Offices

A LIMITED competition has been inaugurated by the English Electric Co. for the planning of their new offices on the site of the old Gaiety Theatre in the Strand, London. The company acquired this commanding site at the end of the Strand some months ago, after repeated efforts to revive the building as a theatre failed. The new building, together with the adjacent Marconi House, will form the enlarged offices of the English Electric Group which have latterly become very necessary. Nine leading architects will compete and the final adjudicators will be Sir Percy Thomas, past president of the Royal Institute of British Architects, and Mr John Murray Easton, F.R.I.B.A. The competition will be run under the rules of the R.I.B.A.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS

B.S. 2490;1954: Waterproof drawing inks; B.S. 1916c and B.S. 1916d; Aug., 1954: Data Sheets, Nos. 1 and 2 for limits and fits in engineering.

AIR DISINFECTION WITH ULTRA-VIOLET IRRADIATION. Report of Medical Research Council. HMSO, 7s. 6d. (see this page).

New Paper Mill is UK's Biggest American Project

FOR the past two years engineers and technicians have been working at Calhoun in Tennessee and the fruition of their labours was announced last week at a press conference, where Mr Arthur Baker of the Bowater Paper Corporation Ltd, gave a description of the largest British enterprise in America since the war. Part of a 60 million dollar project, which includes a 200,000 acre forest, the latest Bowater paper mills have now commenced production, which is initially to be at an annual rate of 130,000 tons newsprint and 55,000 tons kraft pulp. Abundant supplies of local hardwoods provide the raw material.

Power supplies required for the Bowater Mills, Tennessee, amount to nearly 40,000 kW. About half of this is generated from its own plant shown here and the remainder is secured from Tennessee Valley Authority. In the picture are two turbo-generators each of 10,000 kW capacity

Embodying many new features, the mills are of particular interest to electrical engineers since a total capacity of 37 MW is required for the mill operation; of this 20 MW are being provided by 2 turbo-alternator sets and the rest are being supplied by the Tennessee Valley Authority. Steam for the turbines at 875 lb/sq in. and 825° F is provided from 4 boilers having a total output of almost 600 klb/hr. These are fuelled by oil or natural gas—a gas pipeline runs near the site—or in one case with the bark from the trees, it not being possible to utilise the bark in paper-making processes.

The two 10MW turbo-generators have throttle conditions 8580 lb/sq in. and 825° F; for one automatic extraction is at 50 lb/sq in., the condenser having a vacuum of 2½ in. Hg., whereas the other has automatic extraction at 150 lb/sq in. and 50 lb/sq in. back pressure. These sets normally operate in parallel with the supply from the T.V.A. Distribution is normally at 13·8 kV 3-phase 60c/s but a special supply of 4·16 kV is taken through two 15 MVA transformers to eight 4,500 h.p. motors used in the wood grinding operations. Other motors operate on either 2·3 kV or 460 V depending on their size, the dividing line being 200 h.p.

Bumper Hoover Week in Britain Next Month

ANOTHER National Hoover Week is to be held this year. The intensive publicity and sales campaign running during the week from 2 to 9 Oct. will be combined with a Window Display contest for Hoover dealers. Theme of the week will be: "Use a Hoover Product during National Hoover Week." Background to this special week will be the considerable amount of space taken for advertisements in national and provincial newspapers; buses and hoardings all over the country will carry posters and millions of hand bills, stickers, emblems, streamers and showbills are being printed for distribution. At the same time local dealers are asked to co-operate by advertising Hoover products in their local paper advertisements, for which Hoover will supply blocks.

The window display competition is already well established, offering as it does the opportunity of winning not only the trophy, but also many hundreds of pounds in prize money. It will be divided into three classes for electricity board showrooms, departmental stores and home furnishers, and electrical contractors and ironmongers. Local winners in each class will be decided first (each winning a £5. 5s. prize) and then go forward for judging in the national contest. First, second and third prizes of 50, 25 and 15 guineas will be awarded in all three classes. A special 100 guineas prize and challenge cup will be presented for the best display of all.

A further attraction during the Week is the two-day loan of Hoover appliances to prospective customers on request, which has proved a popular and beneficial sales stunt in the past.

The effective assistance which electricity can give to the poultry farmer was suitably shown by the S.E. Scotland Electricity Board at the exhibition held in conjunction with the Tenth World's Poultry Congress in Edinburgh. All aspects of poultry farming are shown and the display included a new incubator, infra-red brooders, a small egg grader and a plucking machine just placed on the market by Cope and Cope Ltd of Reading. In addition there were appropriate demonstrations of the preparation of poultry and eggs for the table

Exhibiting Abroad made Easy by S.I.M.A.

AN admirable service aimed mainly at reducing the cost of exhibiting at overseas trade fairs is being brought into operation by the Scientific Instrument Manufacturers' Association. Like a large proportion of good ideas this one is very simple. SIMA have developed for the use of their members an entirely independent, self-contained, and easily transportable display stand. The unit is the essence of simplicity consisting basically of a central panel with a pedestal in front of it, and two side panels for the mounting of photographs or small displays. The pedestal has a space for sales literature and a slot through which enquiries may be dropped. This type of stand can be easily folded flat for transport by road, rail, sea or air and can be erected anywhere without skilled labour. One of these units can stand alone or any number can be built up into a variety of patterns and shapes, from a rectangle with an office in the centre, to a straight line for the corridor of a public building.

It is intended to take this travelling exhibition to various European countries, not only to known trade fairs and exhibitions but wherever there is interest. A start is to be made at the exhibition being staged jointly with the general assembly of the International Union of Geodesy and Geophysics which opens in Rome on 13 Sept. Sixteen firms will take part in that display, and they will be joined by others as the exhibition moves round the continent. Forty-two members have so far acquired these units. An added advantage of this scheme is that only one man is needed to man the stand, no matter how many units go to make up the whole display.

E.R.A. Answers Cable Heating Queries

BRITISH STANDARD 480:1954, "Impregnated Paper Insulated Cables" makes mention of an E.R.A. Report F/T 183 "Tables of Current Ratings for B.S. Paper-Insulated Cables." This report, which is in an advanced state of preparation, will supersede the much-quoted Report F/T 128, and will specify current ratings and maximum operating conductor temperatures. Pending its publication, the Electrical Research Association has stated that it is willing to answer any queries relating to current ratings for cables in accordance with the new British Standard.

Application to Increase S. African Customs Duties

REPRESENTATIONS affecting the Union Customs Tariff have been made to the Board of Trade and Industries in S. Africa, we learn. A number of electrical items are included in the list of commodities on which it is suggested that duty should be increased. The duty on dry core telephone cables should be raised from various rates to 50%, on electric power cable to 30%, and on p.v.c. cables and wires to 25%. It is also suggested that increases on lampshades should be from 15% to 35%. Any U.K. concern wishing to make representations in respect of these applications are advised to contact the Commercial Relations and Export Dept. of the B.o.T. at Horse Guards Ave, London, S.W.1.

Stage Lighting at Vanbrugh Theatre

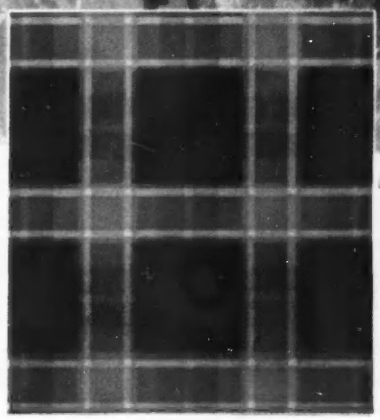
IN our report of the lighting installation at the new Vanbrugh Theatre in our 19 Aug. issue we unfortunately and unintentionally gave the wrong impression concerning the stage lighting. We learn that in fact the whole of the stage lighting (with the exception of the Cyclorama apparatus mentioned) was devised by the Strand Electric and Engineering Co., Ltd., in conjunction with the architect, Mr Allister Macdonald, F.R.I.B.A., and was manufactured by that company. The wiring and installation of this part of the building was also carried out by Strand Electric, and not Bective Electrical Co., Ltd., who were the contractors responsible for the remainder of the building.

The First Half-Century

An interesting development is about to take place in Hackney. At present ordinary customers for electric light are charged a flat rate of 4d. per unit, but from the beginning of next year a maximum demand tariff of 7d. for the first hour and 1d. thereafter will come into operation. Those customers, however, who are on the books at the end of this year will have the option of either method of charging, and it is to be hoped that the borough electrical engineer will let us know in due course how large a proportion of his clients elect to forsake the old tariff for the new. The maximum demand rate will be dearer in cases where the average use of the maximum is less than two hours a day, and cheaper where that period is exceeded. There is a similar arrangement for power users. One can foresee that plenty of long-hour consumers will next year be singing the praises of the M.D. system.—*From our issue of 1 Sept., 1904.*

Famous Scottish Names...

Graham



"The Gallant Grahams", an ancient Scottish line, have played a distinguished role in the country's history from early times. The first Graham to play a notable part in the national story is the subject of the illustration, William de Graeme, who in 1128 was a witness to the Charter by which King David founded the Abbey of Holyrood. Later, there was the famous Sir John who rescued Wallace at Queensberry. It was a John Graham of Claverhouse, Viscount Dundee, whom Sir Walter Scott immortalised in the song " Bonnie Dundee "; he fell in the moment of victory at the battle of Killicrankie in 1689. Legend takes the story of the Grahams back to the time of the Roman Wall across Scotland. It is believed to have been breached by a Graham, an incident which gave it the name of "Graeme's Dyke".

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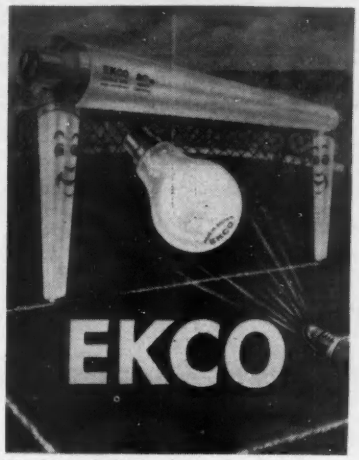
COURSES TO SUIT ALL STUDENTS THIS WINTER

AMONG the numerous books and pamphlets which have reached us recently containing details of courses arranged for the 1954-55 session, are those of the Manchester Advisory Council for Further Education and the Polytechnic, Regent St, London. Manchester's students seem to be well catered for with a large number of courses on varying subjects. At the Royal Technical College, Salford, there are lectures on h.v. transmission, measurement, and heating and ventilating to mention only three, and in Manchester, the College of Technology includes wind tunnel testing and nuclear power in its list.

Full facilities for preparing for the National Certificates, B.Sc.(Eng.), A.M.I.E.E., and City and Guilds of London Institute examinations are provided once again by the London Polytechnic. Session opens on 27 Sept. and enrolment takes place on the 22nd.

Other prospectuses have been received from the S.E. London, Norwood, Wandsworth and Paddington Colleges.



Distributed to the trade to coincide with the opening of the football season was this attractive showcard produced by Ekco-Ensign Electric Ltd. The card measures 12 in. by 10 in. and was produced in full colour by offset litho process

Refresher Course for Plant Engineers

A REFRESHER course on Works Buildings and Services for senior works and plant engineers is being organised by the University of Nottingham. Lectures on a very wide range of subjects will be given by specialists on successive Tuesday evenings beginning on 19 Oct. The syllabus has been arranged with the object of the application of modern techniques in modern engineering practice, and we note that among the many subjects covered are lighting, heating, ventilating and air conditioning, electricity and compressed air services, safety precautions, planned maintenance and the financial aspects of plant installation. Fee for the course, which lasts 20 weeks, is £5. 5s. and all information may be had from the secretary, Dr H. K. Lloyd, Depts. of Civil and Mechanical Engineering at the University, University Park, Nottingham.

Private Power Plant changes Hands for £3,200

THE amount of compensation to be paid in the acquisition of a private electricity undertaking by the North Western Electricity Board has recently been decided by the Electricity Arbitration Tribunal. The undertaking, owned and operated by Mr F. Dinsdale, of Dent, Yorks, was begun about 1920, using a small hydro plant, to supply his own property, but in 1934 he agreed to supply the villagers and subsequently installed a 42 h.p. engine for that purpose. In the acquisition of the undertaking by the Board the amount of compensation was disputed. For Mr Dinsdale it was claimed that the value of the plant, buildings, etc., was £5,715 plus £2,080 for goodwill. But the Board and the B.E.A. contended that there was no goodwill value, and a buyer of the undertaking in the open market would pay no more than £940, i.e. the break-up value of the assets, or alternatively £2,340, representing the second-hand value of the plant *in situ*. It was stated that the annual revenue of the undertaking was £368 plus £152 for Mr Dinsdale's own consumption. Expenditure was put at £243. The B.E.A. contended that £205 depreciation and £104 for services and management should be added to that figure. The Tribunal awarded compensation of £3,200 to Mr Dinsdale.

UV Light Exhibition in Derby Next Week

A SPECIAL exhibition featuring "Ultra-Violet Light in Industry and Commerce" is being staged by Hanovia Ltd. this month. In conjunction with the E. Midlands Electricity Board, they are taking over part of the Board's showrooms in Full St, Derby, between 7 and 16 Sept., Saturday and Sunday excepted. We are told the exhibition will be of special interest to engineers, chemists, laboratory technicians and commercial welfare officers. Among the numerous exhibits displayed will be a water steriliser, air sanitisers, many types of u.v. analytical and inspection lamps and lamps designed for chromatography. There will also be a continuous demonstration of a non-destructive crack detection fluorescence unit.

Commonwealth Markets are No Longer Secure

A WARNING to British manufacturers concerned with Commonwealth markets was given by Mr Arthur R. Sibson, Bulawayo City electrical engineer, at Southampton last Thursday, just before his return to Rhodesia. He said U.K. firms would have to slash prices drastically or be driven from the Commonwealth markets they have controlled for years. They were faced with "cut-throat" competition from foreign concerns. Mr Sibson particularly mentioned competition from France, Germany and Belgium, which was beginning to embarrass those in the Commonwealth countries who wanted to buy in Britain. Public authorities were bound to watch prices, however; they could not ignore them, and the indications were that continental products were likely to be cheaper than British goods for a while. Moreover, some foreign equipment was just as good, he said. While in England, Mr Sibson inspected plant on order for Bulawayo's thermal power station and placed another large order.

British products reach their destination in one of the "far-flung outposts of the Empire." Our photograph shows the rather primitive transport provided on the last stage of the journey of a consignment of Oldham and Son's batteries to their agents, Fraser's Radio Service and Electrical Supplies, in Georgetown, British Guiana

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Two Dances in aid of E.I.B.A.'s Funds

TWO notable social functions are due to take place within the next few weeks in aid of the E.I.B.A. funds. The first is being organised by the E.W.F. and follows a similar event which proved most successful last year. This year's dance, larger than the 1953 event, will take place at Londonderry Hse, Park Lane, London, on 24 Sept. A limited number of tickets are available from Mr R. W. Holledge of Stearn Electric Co., Ltd., 31 Vauxhall Bridge Rd, S.W.1. They cost 32s. 6d. each and include a buffet supper.

The Birmingham branch of E.I.B.A. are holding their annual carnival dance on 8 Oct. at the G.E.C. Magnet Club, Witton. Tickets for this social evening will be available shortly from Mr L. Wall, Electrical Components Ltd., Ludgate Hill, Birmingham 3.

Focus on Steam Turbines

HOW do steam turbines work? A new publication entitled "Large Steam Turbines," issued by the publicity organisation of the General Electric Co., Ltd., gives the answers in a clear, non-technical manner. Divided into sections, each dealing with a phase of the subject, the publication covers the design, research and construction of present day turbines. Governors and feed-heating are each devoted a chapter and finally a description of some typical installations and sectional drawings of various ratings of turbine, up to 120 MW, completes this excellent work. Liberally illustrated, the publication is a companion to "G.E.C. Electrical Plant for Power Generation," which describes alternators and other equipment complementary to steam turbines.

NEWS IN BRIEF

Annual meeting of the E.I.B.A. will be held on 22 Sept at the I.E.E., Savoy Place, W.C.2, at 11 a.m.

An additional hour of test transmissions from 12 noon to 1 p.m. daily (except Sundays) began yesterday (Wed) from all B.B.C. T.V. stations. Transmissions comprise Test Card C accompanied by recorded music.

Course on Staff Management has been organised by the Institute of Personnel Management and L.C.C. College for Distributive Trades. It will take place on Wednesdays beginning on 22 Sept. Fee is £3. 3s.

Midlands Radio Industry Golfing Society four-ball alliance match at Little Aston was won by Messrs C. A. Jenkins and J. A. Lloyd with 74 net.

As previously reported in these columns a British-Swedish Chamber of Commerce is being established in Sweden in an effort to counter the rapid growth of German trade in that country. The Chamber's headquarters in Stockholm will be officially opened by the Minister of Works, Sir David Eccles, on Tuesday.

ELECTRIC SUPPLY NEWS

Belfast

The Corporation Electricity Committee should avail themselves as far as possible of the advantages of free competition when contracts are under consideration, the Local Government Auditor, Mr C. Smyth, suggests in his report on the accounts for the year ended Mar. 1953. In each case where there had not been competition, he says, the Committee appeared to have been satisfied that special circumstances existed within the meaning of the Standing Orders. After hearing the various technical explanations in favour of negotiation, he came to the conclusion that the Committee was justified in taking that course. But in view of the changing economic conditions, he hopes that the number of contracts entered into by negotiation will decrease.

Blyth

Plans for what will probably be the largest power station in the Northeast of England, to be built at Blyth, Northumberland, have been announced locally. We understand that the B.E.A. has made application to the Minister of Fuel and Power for statutory consent to the construction of the station. Sanction is being sought for the first stage, comprising four 120 MW turbo-alternators each with its own boiler unit, reheat being employed. The first set is scheduled to be in commission at the end of 1957. The station site is on the north bank of the River Blyth, at Cambois. The latest extraction plant for minimising grit emission will be installed, and ash will be sluiced away from the power station for disposal at sea. Estimated cost of the first stage is put at £30 millions. The station will be connected to the 275 kV super-grid system, and initially will use about a million tons of coal a year. Concern has apparently been expressed at the effects of the use of large quantities of coal by this station on coal shipments from Blyth, which at present amount to about six million tons a year. An official of the National Coal Board has said that the port is crying out for more coal to ship and the advent of this station means that the N.C.B. will have considerable difficulty in maintaining, let alone increasing, the shipments.

Castle Donington

The construction site of the new Castle Donington power station was flooded to a depth of two ft or more in places last week when water poured through a breach in the bank of the River Trent following heavy rain. But the water was quickly pumped away and it is not expected that the constructional work will be affected.

Durham

Plans by the North-Eastern Electricity Board for the erection of overhead lines and the reinforcement of existing networks taken over from the National Coal Board in the following areas have been approved by the County Planning Committee:—Shotton Colliery, Blackhall Colliery, Craghead, West Herrington, and Shotton Village.

Tarbert

At the switching-on ceremony last week, Mr Thomas Johnston, chairman of the North of Scotland Hydro-Electric Board, said it had been necessary to make a hard choice between postponing the scheme for Harris or imposing a line rental charge for seven years. After consulting Harris District Council it had been decided to go ahead on the line rental basis, and on that basis the Board would be able to supply electricity to 90% of the people of Harris. We understand that already 95% of the potential consumers in Harris have asked for an electricity supply.

LIGHTING SCHEMES

Birmingham. The Public Works Committee has recommended the spending of another £8,000 on improving street lighting.

Blyth. The T.C. has completed the second stage of its electric street lighting improvement scheme and estimates are being prepared for the third and last stage.

Carshalton. The Highways Committee are considering a plan to improve street lighting when the present contract expires in Sept. 1955.

Sayings OF THE WEEK

"Socialists, in my view, should be cautious in accepting too readily the 'obvious' case for top-to-bottom co-ordination of fuel and power, especially when—as is now often true—the demand comes from bitter industrial opponents of public ownership in general and nationalisation in particular" . . . Mr A. M. F. PALMER, writing in *The Tribune*.

"Parents have not the expected influence on their children's choice of a career" . . . according to an interim report of the Commercial and Industrial Affairs Committee of the Derby and Derbyshire Junior Chamber of Commerce.

"Competition from France, Germany and Belgium is beginning to embarrass those who want to buy in Britain. As a public authority we cannot ignore prices, and the indications are that continental markets are likely to be cheaper than British for a while. Some of the foreign equipment is just as good" . . . Mr A. R. SIBSON, city electrical engineer of Bulawayo, stated last Thursday prior to returning to Rhodesia.

COMPANY ACTIVITIES

WITH the preliminary results for 1953, Sir Alexander Roger, chairman of Telephone Properties, announces that the board has approved the publication to stockholders of full details of the proposed reorganisation scheme. The basis of the scheme is an option under which Ordinary stockholders may either exchange the greater part of their stocks for shares of the new realisation company, or retain the whole of their present holdings.

The full report of Thorn Electrical confirms my previous estimate of the strength of this virile undertaking, profits of which have advanced ten-fold since the war, under the management of Mr Jules Thorn.

If dividends have been kept down it is only because Mr Thorn needed the money to take care of constant expansion in sales. In the year under review he untied the purse-strings a little more by raising the dividend from 12½% to 20%. Even so, that payment is covered five times over. Perhaps there will be further relaxation next time when E.P.L. is out of the way. Additionally, the company has just raised £500,000 of 4½% Unsecured Loan Stock which further eases the financial position and should allow a more generous attitude to shareholders.

Looking ahead, Mr Thorn is now going into the possibilities of the production of cathode ray tubes for colour television.

Impressive results have been secured by Steel and Co. of Sunderland. Latest dividend is 20% against 15%, out of earnings of nearly 61%. Ex-E.P.L. the earnings yield is 85%. In addition there is to be a 50% share bonus for which Capital Issues Committee consent has already been obtained. At 17s. the Ordinary shares yield just over 6%.

Consolidated trading profit of Hackbridge Cable Holdings group for the year to March last fell to £247,401 compared with £403,354. But the dividend is to be maintained at 20%. Shareholders were warned last September that as important buyers were restricting their purchases to a minimum they should not expect the 1953/54 figures to reach those of 1952/53. In his annual statement this time, Mr Claude I. Steen, the chairman, states that last year's output compared most favourably with earlier years apart from 1952/53, bearing in mind the variations in commodity prices. For the current year he says that trading has continued to be satisfactory, and confidently expects that the results will again be favourable.—*From our City Correspondent.*

Brook Motors Ltd.

An extraordinary meeting is being held on 24 Sept. to consider proposals to increase the authorised capital from £700,000 to £1,000,000 by the creation of 600,000 Ordinary 10s. shares. Treasury consent has been obtained to issue 142,761 fully paid Ordinary 10s. shares in the proportion of one-for-seven. These new shares will rank *pari passu* with existing Ordinary shares. In the absence of unforeseen circumstances the directors expect to recommend a final dividend of 15% (*same*) on the increased capital.

Dubilier Condenser Co. (1925)

The value of the sales turnover for the past year was almost equal to that of the previous year, but to achieve this it was necessary to manufacture and sell a larger volume of products at reduced prices, Mr W. H. Goodman, the chairman, states. Export business was maintained despite several competition and exchange difficulties. The extensions to the Acton and Kirby factories are completed and as new plant is delivered it is put into commission, he adds. But he warns that the value of outstanding orders is less than a year ago and competition is intensifying. The proposed one-for-four scrip issue we referred to on 5 Aug. last.

Year to Mar. 31	£ Trading Profit	Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	151,401	49,860	105	20*	2/7	1/3
1951	214,750	69,790	100	20	3/3	2/1
1952	411,212	130,832	194	28†	3/1	1/6
1953	419,639	114,588	115	25	4/4	2/10
1954	351,958	112,765	113	25‡	6/4	4/1

*Plus 60% capital bonus.
†Plus 40% capital bonus.
‡Plus 25% capital bonus.

Hackbridge Cable Holdings Ltd.

For the year to 31 Mar. last the consolidated trading profit, after depreciation, is £247,401, compared with £403,354 for the previous year. With a final dividend of 12½%, the distribution is again 20%. In this statement accompanying the accounts, Mr C. I. Steen, the chairman, refers to his warning last year that it was not to be expected that the result would reach the record 1952-53 figure. Output for the past year compared most favourably with earlier years, he adds.

Steel and Co. Ltd.

This Sunderland engineering concern which manufactures electric cranes, among other things, reports a group profit of £558,106 (*£334,947*) for year ended 28 Mar. last. After taxation, etc., the net profit is £180,828 compared with £128,983 a year ago. The final dividend is 15%, raising the total distribution to 20%—an increase of 5%. It is proposed to capitalise £250,000 from reserves to make a one-for-one scrip issue, for which C.I.C. permission has been obtained.

Sterling Cable Co. Ltd.

This concern suffered a sharp setback in its profits for the year ended 31 Mar. last, it will be seen from the accompanying table. Mr J. S. Clark, the chairman and managing director, states these results reflect the difficult trading conditions met in the latter part of the financial year. During the year much time was devoted to the development of new types of cable for the communications industry. Benefit is now being felt from this work. The order book is once again assuming the healthy proportions of some two years ago, but he warns that foreign competition continues to be irksome and to curtail profit margins.

Year to 31 Mar.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid
1950	68,457	17,921	8	5
1951	102,331	25,625	11	7½
1952	127,303	31,682	16	12½
1953	162,513	41,109	22	15
1954	114,488	22,427	8	10

Sterling Industries Ltd.

After writing off £10,000 in respect of redundant stocks, there is a group loss of £71,564 for the year to 31 Mar. last, according to the preliminary statement. For the previous year, there was a net profit of £28,703.

Telephone Properties Ltd.

The preliminary statement concerning results for the year ended 31 Dec. last shows a net profit of £35,252 compared with £60,964 for the previous year. The Ordinary dividend is again 8%. The directors also announced full details of the proposed reorganisation scheme last Monday.

Thorn Electrical Industries Ltd.

The remarkable expansion of this concern over the past five years is clearly reflected in the results shown in our accompanying table. It is also indicated in the value of stocks, stores and work in progress at the end of Mar. last, listed at £3,163,728, compared with £2,277,862 a year ago. Current assets in all total £5,406,440, (*£4,254,560*), while liabilities amount to £3,573,259 (*£2,335,932*). It is also announced that the issue of £500,000 4½% Unsecured Loan Stock 1972/74 was subscribed between four and five times.

Year to Mar. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	231,738	48,816	37	20	22/3	16/3
1951	517,323	155,218	51	10*	12/2	8/3
1952	681,169	195,885	66	12½	8/9	7/–
1953	771,292	192,074	62	12½	13/6	7/10
1954	1,054,348	293,608	97	20	24/6	13/3

*Plus 100% capital bonus.

Dividends Declared

Brown Brothers and Co. Interim of 2½% (*same*).

Cable and Wireless Holdings. Interim of 3% (*same*) but on capital increased by 10% scrip bonus.

Desoutter Bros. (Holdings). Interim of 10% (7½%).

Lancashire Dynamo Holdings. Interim of 4% (*same*).

C. A. Parsons and Co. Interim of 3½% on the Ordinary capital which was increased last October by a 100% scrip issue and 100% rights issue. Last year's interim, on the old capital, was 6½%.

West London and Provincial Electric and General Trust. Interim of 4% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

3 Sept.—Aberdeenshire. Mercury vapour street lights in Aboyne.—See 19 Aug. issue.

3 Sept.—Co. Tyrone. Installation at Dungannon secondary intermediate schools.—See 8 July issue; closing date has been altered.

4 Sept.—Clare (Suff.) R.D.C. Wiring of 56 houses at Wickhambrook, Stansfield, Denston, and Hawkedon.—See 19 Aug. issue.

4 Sept.—Stamford T.C. Lighting and power points in total of 569 prewar council houses and 24 bungalows.—See 12 Aug. issue.

4 Sept.—Rothwell (Yorks) U.D.C. Street lighting units with concrete columns on coal industry housing site, Oulton.—See 26 Aug. issue.

6 Sept.—Sandbach (Ches.) U.D.C. Columns and lanterns of class B in various streets.—See 19 Aug. issue.

6 Sept.—Wellingborough U.D.C. Columns with fluorescent lanterns for Group A street lighting.—Advertised in 12 Aug. issue.

7 Sept.—Hale (Ches.) U.D.C. Concrete columns, lanterns, lamps, wiring, etc., for Delahays Rd estate.—See 26 Aug. issue.

7 Sept.—St. Albans T.C. Installation in 100 houses.—See 26 Aug. issue.

8 Sept.—Billericay U.D.C. Supply and erection of 29 sodium discharge lamps on steel or concrete columns in High St. Surveyor to Council, Council Offices.

8 Sept.—Bolton T.C. Duplicate set of electrically driven and automatically controlled booster station equipment.—See 12 Aug. issue.

8 Sept.—Luton T.C. Steel columns and fluorescent and sodium lighting equipment along A.6.—See 19 Aug. issue.

8 Sept.—Spenborough U.D.C. Concrete columns and equipment along A 649 and A 643.—See 26 Aug. issue.

9 Sept.—Prestatyn (Flint) U.D.C. Supply and erection of 98 class A street lamps with concrete columns and sodium discharge lanterns; also 28 60 W sodium discharge lanterns with control gear, etc. T. Grant, engineer, Council Offices. Deposit £1. 1s.

10 Sept.—Belfast T.C. Fire extinguishing equipments for substation.—Advertised in 19 Aug. issue.

10 Sept.—Eire. Installation in dispensary and clinic at Blackrock.—See 19 Aug. issue.

10 Sept.—Fifeshire. Electrical installation at Auchtermuchty secondary school. Frank W. Raynes and Son, 40 Second Ave, Cathcart, Glasgow.

10 Sept.—Mansfield T.C. Concrete steel columns, lanterns and other fittings for main road lighting.—See 26 Aug. issue.

10 Sept.—West Riding. Electrical fittings for County Architect's Dept.—See 26 Aug. issue.

11 Sept.—Durham T.C. Electrical installation at Dunston Hill county and modern schools, and Greatham C.E. controlled school. Apply by above date to G. R. Clayton, county architect, Court Lane.

11 Sept.—Newmarket U.D.C. Mercury vapour street lighting units and tungsten units with concrete columns.—See 19 Aug. issue.

11 Sept.—Spilsby (Lincs) R.D.C. Installation of power points in total of 36 council dwellings. G. F. Taylor, Housing Manager, Toynton Hall.

11 Sept.—Wayland (Norf.) R.D.C. Installation in 10 council houses. J. Bamford, Housing Officer, Council Offices, Attleborough.

13 Sept.—Batley T.C. Installation of lighting and power points in new buildings at Victoria Ave cleansing depot. Borough Engineer and Surveyor, Hanover St.

13 Sept.—Dublin T.C. Installation in Technical School for Girls in Crumlin Rd.—See 29 July issue.

13 Sept.—Middlesex. Lamps for year ending 31 Oct., 1955.—See 19 Aug. issue.

13 Sept.—N. Ireland. Supply of electric lamps to Fermanagh County Hospital and Erne Hospital, Enniskillen, in year from 1 Oct. Secretary, Fermanagh Hosp. Management Committee, Fermanagh Hospital, Enniskillen.

13 Sept.—Peterlee (Dur.). Installation in 310 houses on Acre Rigg sites.—See 19 Aug. issue.

13 Sept.—Stepney B.C. Installation of lighting and power points at Paving Depot. Borough Engineer and Surveyor, 227 Commercial Rd, E.1. Deposit £2. 2s.

11 Sept.—Stone U.D.C. Supply and installation of group A street lighting in Stafford and Eccleshall Rd. Engineer and Surveyor, Town Hall.

16 Sept.—Belfast T.C. Metering equipment.—Advertised in 12 Aug. issue.

16 Sept.—Belfast T.C. Installation in Ballygomartin intermediate school.—See 26 Aug. issue.

17 Sept.—Sheffield T.C. Installation in 132 dwellings on Greenhill-Bradway estate.—See 19 Aug. issue.

17 Sept.—Wolverhampton T.C. Mercury and tungsten street lighting, including columns, lanterns, auxiliary control gear and time switches.—Advertised in 26 Aug. issue.

17 Sept.—Wortley R.D.C. Class A street lights at Chapeltown, nr. Sheffield.—See 12 Aug. issue.

17 Sept—Yiewsley and W. Drayton U.D.C. Steel columns with lanterns, lamps and control gear.—See 26 Aug. issue.

18 Sept.—Burton-on-Trent T.C. Equipment for three street lighting schemes.—Advertised in 19 Aug. issue.

18 Sept.—Wirral U.D.C. Steel columns with lanterns, etc., for street lighting at Irby.—See 26 Aug. issue.

20 Sept.—Lancashire. Wireless equipment for ambulance service.—See 12 Aug. issue.

21 Sept.—Melford (Suff.) R.D.C. Wiring in 328 houses.—See 26 Aug. issue.

22 Sept.—Peterhead T.C. Laying of electricity services in site preparation at Clerkhill for erection of 130 houses. Burgh Surveyor, Municipal Chambers.

23 Sept.—Co. Antrim. Electrical installation in new primary school at Larne. A. N. Irens, consulting engineer, 58 Howard St, Belfast. Deposit £3. 3s.

23 Sept.—Newark-on-Trent T.C. Supply and erection of 44 concrete columns and 150 W tungsten lanterns for group B lighting in Bowbridge and Boundary Rds. Same for 26 Stanton type columns, Metrovick SS51 lanterns and 150 W tungsten lamps in group B for Sherwood Ave and Beacon Hill Rd. Borough Surveyor, Municipal Buildings. Deposit £2. 2s.—Advertised in this issue.

24 Sept.—Belfast T.C. Supply of fluorescent street lighting lanterns, brackets and concrete columns. Tender form W.46. Electricity Dept., East Bridge St. Deposit £2. 2s.—Advertised in this issue.

27 Sept.—Plympton (Dev.) R.D.C. Seven sets electrically driven sewage pumps.—See 19 Aug. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100 000 entries

A Selection from the 120 queries answered this week

"Mitre" towel rails, makers of? W.H.P.—Albany Sheet Metal Eng. Co. (Oldham) Ltd., Albany Mills, Vulcan St, Oldham, Lancs.

Inductive levelling switches as used in lift control, makers of? G.I.C.—Express Lift Co., Ltd., Greycoat St, S.W.1; Keighley Lifts Ltd., Dalton Lane, Keighley, Yorks; Dewhurst and Partner Ltd., Inverness Works, Inverness Rd, Hounslow, Middx.

Moving window display described as a "Flying Saucer," makers of? J.T.C.—We presume this refers to the "Matic Rings" unit, which comprises two rings joined at an angle which when revolving appear to be independent—the makers are: Kirdon Electric Ltd., Factory Yard, Uxbridge Rd, Hanwell, W.7.

Ultrasonic test equipment for rail flaws, suppliers of? U.T.A.—Mullard Ltd., Century Hse, Shaftesbury Ave, W.C.2; Matisa Equipment Ltd., 78 Buckingham Gate, S.W.1; Equipment and Eng. Co., 2 Norfolk St, W.C.2.

Industrial electrical incinerator for sawdust, makers of? B.T.E.—We have been informed that such a product would have to be specially designed as the electrical disposal of sawdust presents difficulties.

"Abco" chrome plated lampholders, makers of? T.E.—Samuel Heath and Sons Ltd., Leopold St, Birmingham.

30 Sept.—Thetford T.C. Concrete columns to group "A" with lamps, lanterns and auxiliary equipment along A 11. —Advertised in 26 Aug. issue.

22 Nov.—N. of Scotland H.E. Board. Supply, erection, etc., at Carolina Port power station of a steam turbine-driven boiler feed pump and electrically-driven boiler feed pump for supplying two 680 PSI 150,000 lb/hr steam generating units. P. Philip, Area Manager, 7 Dudhope Crescent Rd, Dundee. Deposit £2. 2s.—Advertised in this issue.

No date stated.—N. of Scotland H.E. Board. 132 kV steel tower overhead transmission line from Clunie to Charleston.—Advertised in 26 Aug. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

20 Sept.—Australia. Electricity Commission of N.S.W., Kelvin Hse, Castlereagh St, Sydney, invites tenders (No. 319) for supply of 11,000 V 50 c/s 3-phase shunt capacitor bank rated at 3 MVR for Dubbo Railway goods yard. B.o.T. (Ref.: ESB 20451/54).*

24 Sept.—New Zealand. Supply of 50,000 yds of ·0145 sq in. bare hard drawn stranded cable for Auckland electric Power Board, Queen St, Auckland.

27 Sept.—Australia. Supply of weatherproof transformers for Fairfield and Holroyd substations of Electricity Commission of N.S.W., Kelvin Hse, Castlereagh St, Sydney. B.o.T. (Ref.: ESB 20452/54).*

27 Sept.—Australia. Supply of 33,000 V three-phase oil immersed natural cooled regulating transformer with 30,000 kVA through-put for Blacktown substation of Electricity Commission of N.S.W. Contract 304. B.o.T. (Ref.: ESB 20453/54).*

28 Sept.—Australia. Supply of ten 415V, 3-phase indoor type circuit-breakers for Electricity Trust of S. Australia, N. Terrace, G.P.O. Box 4120, Adelaide. Tender No. 653. B.o.T. (Ref.: ESB 20390/54).*

1 Oct.—Australia. Supply of three 200W 12 V d.c. steam turbo-generators for Melbourne Harbour Trust Commissioners, 29 Market St, Melbourne. Documents from A. E. Turner and John Coates and Co, Ltd, Victoria Hse, Melbourne Place, Strand, London W.C.2.

1 Oct.—U.S.A. Tenders invited (No. CIVENG-35-026-55-29) for main unit generators for Dallas Dam power house. U.S. Army Corps of Engineers, 628 Pitlock Block, Portland, 5 Oregon. B.o.T. (Ref.: ESB 19540/54)*

15 Oct.—Tangier. Construction of l.t. overhead line in Anfa district of Tangier and a 22.000 V o.h. line along Airfield Rd, for Water and Electricity Supply Board, 4 Rue Vermeer, 3ème Etage, Tangier. B.o.T. (Ref.: ESB 20165/54).*

18 Oct.—Morocco. Installation of public lighting in various streets in Tangier. La Regie des Services de l'Eau et de l'Electricité, 4 Rue Vermeer, 3ème Etage, Tangier. B.o.T. (Ref.: ESB 20284/54).*

29 Oct.—New Zealand. N. Auckland Electric Power Board requires supply of power transformers, switchboards, air break switches. B.o.T. (Ref.: ESB 20054/54)*

19 Oct.—Portuguese W. Africa. Supply of various equipment for supply of electricity to town of Gabela. Documents available from Hugo International of Rue Crucifixo 76-4°, Lisbon, at Esc. 120,000. Local representation essential. B.o.T. (Ref.: ESB 20389/54).*

31 Oct.—British E. Africa. Supply of 33 main and 131 secondary road lighting units, including lanterns, lamps, fittings, etc., for E. African Power and Lighting Co., Ltd. B.o.T. (Ref.: ESB 19729/54)*

16 Nov.—Belgian Congo. Supply, installation and starting up an electricity distribution plant at new airport at Leopoldville. Tender No. 587. Ministry of Colonies, Brussels. B.o.T. (Ref.: ESB 19754/54)*

8 Dec.—Australia. State Electricity Commission of Queensland invites tenders (No. TF/19) for one water driven turbo alternator 18,000 kW required by Cairns Regional Electricity Board for Tully Falls project. Documents at Agent-General for Queensland's office, 409 Strand, London, W.C.2.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 31 August

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	240	+½	228½
„ (3 months)	236½	−1	215½
LEAD, refined pig, min. 99·97% purity (cash)	99	—	95½
„ (3 months)	97½	−½	91½
TIN, refined, min. 99·75% purity (settlement)	730	−2	623½
„ (3 months)	729	−3	613½
ALUMINIUM, ingots 99-99·5%	156	—	150
ZINC, virgin, min. 98% purity (cash)	77½	—	72 5/16
„ (3 months)	77½	—	72 5/16
RUBBER No 1, RSS, spot (per lb.)	20⅛d.	+½	19d.
„ c.i.f. basis, ports, Oct. (per lb.)	20 1/16d.	+1/16d.	19⅛d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52	—	50½
Mild Steel Tape (0·014 in.)	40½	—	40

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Terco. 728,622. Class 9. Electrical apparatus and instruments for use in the repair of tyres of natural or synthetic rubber. Tyre Equipment and Reconditioning Co., Ltd., Palace of Eng, Wembley.

Consort. 730,923. Class 9. Apparatus for recording sound on oxide coated tape by means of magnetic impulses. Associated Cine Equipment Ltd., 353 Bexley Rd, Erith, Kent.

Trublo. B729,661. Class 9. Fuses. Belling and Lee Ltd., Cambridge Arterial Rd, Enfield, Middx.

Monocox. 730,819. Class 7. Pumps. Mono Pumps Ltd., 1 Sekforde St, E.C.1.

Visophone. 723,608. Class 9. Television apparatus. Pye Ltd., Radio Works, St. Andrews Rd, Cambridge.

Gazette Announcements

Voluntary Liquidation

B.C.R. Installations Ltd., electrical contractors. Resolution for voluntary winding-up passed at meeting on 13 Aug. Liabilities of £2,279, all due to unsecured creditors, were shown in statement of affairs submitted at statutory meeting of creditors. Assets of a book value of £2.030 were estimated to realise £1.582 and after allowing £338 for preferential claims, there were net assets of £1.244, or deficiency of £1.034. Creditors passed resolution confirming voluntary liquidation with Mr D. Morgan, incorp. acc., of 100 Park St, London, W.1, as liquidator, with committee of inspection.

Partnership Dissolved

Refrigeration South Coast. Partnership between Roy D. Geear, George W. Pilbeam, and Rex W. Clarke, trading at 3 Lansdowne Mews, Farm Rd, Hove, dissolved as from 2 June, so far as concerns R. W. Clarke who retires.

BANKRUPTCY ACTS

Dividends

London. Murdoch C. Usher, electrical contractor of 31 Ranelagh Garden Mansions, Hurlingham, S.W.6. First and final dividends of 2s. 9¼d. in £ payable tomorrow (3 Sept.) at Bankruptcy Buildings, Carey St, W.C.2.

Banbury. Herbert F. Thorrington, electrical contractor of Eydon, Northants. First and final dividends of 10½d. in £ payable at Official Receiver's Office, 58-61 York Terrace, Regent's Park, London, N.W.1, on 9 Sept.

Kingston-on-Hull. Harry G. Willingham and Henry Baxter, trading as Star Ventilation Co. at 6-12 Commercial Rd, Hull. First and final dividends of 2½d. in £ payable on 7 Sept. at 4 Silver St, Hull.

Croydon. Sidney D. Bennett, electrical engineer trading at 2 Burnt Ash Parade, Lee. First and final dividend of 2s. 5d. in £ payable tomorrow (3 Sept.) at Official Receiver's Office, 58-61 York Terrace, Regent's Park, London, N.W.1.

Receiving Order.

Sheffield. Albert C. Payne, electrician of 40 Springfield Rd, Wickersley, Rotherham. Date of receiving order, 23 Aug.

Amended Notice.

Leicester. Thomas G. Coaton, electrical engineer trading at 16 Humberstone Rd, Leicester. Supplemental dividends of 2 9/16d. in £ payable on 11 Sept. at Official Receiver's Office, 27 Regent St, Park Row, Nottingham.

BUSINESS PROSPECTS

Home

Aldridge (Staffs). Approval given to erection of secondary school at a cost of about £187,000.

Belfast. Construction of St. Monica's intermediate girls' school in Ravenhill Rd. John A. Tynan, quantity surveyor, 68 Royal Ave.

Belfast T.C. Building of church in Oldpark Rd. Quantity surveyor, J. A. Tynan, 68 Royal Ave.

Birkenhead. Architects for new premises proposed by Dale Forty and Co., Ltd., London, are North and Partners, 40 Broad Way, Maidenhead.

Birmingham. Erection of Bush House to be completed at estimated cost of £464,200.

Birmingham. New factory and offices to be built for Greville Tinners Ltd., of 12a Johnstone St. T.C. inviting tenders for erection of building comprising 17 shops, 18 flats and offices at Heathway, Sharp End. A. G. Sheppard Fidler, City Architect, Civic Centre.

Cambridge. Prudential Assurance Co. are planning to build block of shops and offices on site in St. Andrew's St.

Cheshire. Sketch plans approved for first instalment of Hartford Mid-Cheshire College of Further Education. Estimated cost £213,650.

Crawley. Erection of 541 dwellings in stage 2 of Ifield schemes. Chief Architect of Development Corpn., Broadfield, Crawley.

Crayford. Metropolitan Water Board to extend pumping station at an estimated cost of £113,500.

Douglas (I.o.M.). Erection of extensions at carpet factory in Peel Rd providing for offices and showrooms.

Durham. R.C. secondary school to be built in Mill Lane area, Hebburn-on-Tyne. G. R. Clayton, County Architect, Court Lane. New junior and infants' school proposed at Framwellgate Moor.

Easington R.D.C. It is proposed to erect 177 houses at Murton as first part of slum clearance scheme.

Easton (Norf.). Additional accommodation at School of Agriculture is estimated to cost £35,000.

Edinburgh. Dean of Guild Court has approved erection of £67,000 factory on Sighthill industrial estate for Laidlaw Drew and Co., Ltd., Leith.

Gt. Yarmouth. Provisional scheme approved by T.C. for erection of ballroom and conference hall for M. Apple, London. Cost estimated at £125,000.

Harlow (Essex). Greaves and Thomas Ltd. propose factory on industrial estate. Architect is G. Coles, 40 Craven St, London, W.C.2.

Haltemprice (Yorks) U.D.C. It is proposed to acquire site in Central Ward area for construction of 250 houses.

Hatfield. Stafford-Miller Ltd. planning to erect factory. Plans by Louis de Soissons and Partners, Midland Bank Chambers, Welwyn Garden City.

Lanarkshire. John Laird and Sons Ltd., Glasgow, propose to build factory at Sandyhills. Architects are George Boswell, Mitchell and Johnstone, 256 West George St, Glasgow.

Llanidloes (Mon.). Sandringham Leather Goods Ltd. are planning to erect factory near Westgate St.

Meriden (War.) R.D.C. Approval granted to layout of site off Birmingham-Coventry Rd providing for 134 houses, 10 bungalows, etc.

Middlesbrough T.C. Erection of further 48 houses on Park End estate. J. A. Kenyon, Borough Engineer.

Newry (Down). Erection of new intermediate boys' school in Armagh Rd. W. H. McEvoy, surveyor, Ulster Bank Chambers, 7 May St, Belfast.

Northumberland. Dene Cinemas Ltd., 59 Grey St, Newcastle, are negotiating for purchase of former Bridge St (Cambois) Methodist Church, for conversion into cinema.

Plymouth. Plymouth Process Engraving Co., Ltd., of Ivybridge, are to build new factory in Tothill Rd.

Sedgefield R.D.C. Erection of 10 shops with flats at Trimdon Village, and six shops with flats at W. Cornforth. R. P. Burton, clerk to council. Council Offices, Sedgefield, Stockton-on-Tees.

Slough. I.C.I. Ltd.'s Paints Div. propose to extend laboratory building.

Stockton-on-Tees T.C. Construction of 23 houses and 42 flats at Newtown. Borough Architect, 28 The Square.

Totnes T.C. Erection of 17 houses and 13 bungalows on Farwell estate. J. Smith, Borough Engineer, Municipal Offices.

Worksop T.C. Erection of 50 houses on Kilton Hill site. Borough Engineer, Park Hse, Park St.

Overseas

Cuba. J. Z. Horter Co., S.A., Obispo 61, Havana, want to contact U.K. manufacturer of high class plastic acid resisting tape for covering electric wire (width about ¾ in.).

Kuwait. Kuwait Engineering and Trading Co. are interested in importing materials suitable for hotels and luxury premises; also in domestic electrical fittings, cable and equipment, builders' hardware, etc. Address is P.O. Box 144, Kuwait.

Pakistan. Sole distributorship, purchasing on their own account, in respect of refrigerators and refrigeration parts, pumping sets, generators, etc., sought by Federal Automobile Agencies, 70 Garden Rd, Karachi.

TRADE NOTES

Changes of Address. Langley, London, Ltd, have moved to larger premises at 163/7 Borough High St, S.E.1. The telephone number remains Hop 4444.

The London office of Davey Paxman and Co., Ltd, is now at 1 Balfour Place, Mount St, W.1. Telephone, Grosvenor 6114.

The Davis Sheet Metal Engineering Co., Ltd, have found it necessary to acquire a new and larger factory to handle the increasing demand for their cable trunking ,etc. Their new address is: Eley's Estate, Angel Rd, Edmonton, N.18. Telephone Edmonton 2492.

Sudan Duties. Under recently introduced Sudanese Import and Consumption Duties, household machinery and appliances operated by electricity (excluding radio sets and refrigerators) now carry a duty of 50% *ad valorem*. On electric generators, motors, locomotives and transformers (weighing over 50 kilograms) the duty is 6% *ad valorem*, and on all types of refrigerators the duty is 30% *ad valorem*.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Fischer Electronics Co., Ltd., 70 Brewer St, W.1. Nom. cap.: £100. Dir.: W. Fischer.

S. T. Lambourne Co., Ltd., 5 Henrietta St, Strand, W.C.2. Machine belting manufacturers and merchants, power transmission engineers, etc. Nom. cap.: £50,000. Dirs.: W. T. Lambourne and L. G. Lambourne.

Elekraft Ltd., 123 The Avenue, Hornchurch, Essex. Electrical engineers and contractors, etc. Nom. cap.: £500. Dirs.: A. H. Slingsby, K. L. Hutchings and T. J. Jennings.

Merimex Industries (London) Ltd., 7 Haymarket, S.W.1. Merchants, bankers, traders, etc. Power is taken to carry on business of electrical and general engineers and contractors, etc. Nom. cap.: £5,000. Dirs.: Not named. Subs.: P. A. C. Smith and P. Brusey.

Beccar Ltd., Clifford Ct, 3 Cork St, W.1. Experimental mechanical, hydraulic, automobile, electrical, radio and general engineers, etc. Nom. cap.: £100. Dirs.: J. Lee and Winifred Brown.

"Parts" Peerless Auto-Electrical and Radio Trade Services Ltd., St. James St, Taunton. To take over business of manufacturer and repairer of electric, radio, television, electric amplifier, public address, automobile, cycle and gramophone equipment, wholesale distributor and replatal repairer of lighting, radio, automobile and traction batteries of all kinds, carried on as "P. Taylor," at Taunton. Nom. cap.: £12,000. Dirs.: P. Taylor, C. P. Taylor, and E. A. Evans.

G. Hopkins and Sons (Northern) Ltd., 57 Holloway Rd, N.7. Merchants and agents for the sale of brewery, dairy, general, mechanical, electrical and other engineering products, etc. Nom. cap.: £100. Dirs.: F. L. S. Gunner, H. H. Stokes, A. A. G. Ashton, J. L. Harvey, and C. M. Wales.

MEETINGS TO NOTE

THURSDAY, 2 SEPT.

SCOTTISH INDUSTRIES EXHIBN. at Kelvin Hall, Glasgow. Closes on 18 Sept.

TUESDAY, 7 SEPT.

INCORP PLANT ENGRS. (Edinburgh). "Oil Firing of Steam Boilers." J. R. Henshilwood, 25 Charlotte Sq, 7 p.m.

INCORP. PLANT ENGRS. (London). Open Forum at Royal Soc. of Arts, W.C.2, 7 p.m.

INCORP. PLANT ENGRS. (Manchester) Film: "Principles of Automatic Control." Engineers' Club, Albert Sq, 7.15 p.m.

WEDNESDAY, 8 SEPT.

WELSH INDUSTRIES FAIR at Sophia Gdns. Pavilion, Cardiff. Continues until 18 Sept.

THURSDAY, 9 SEPT.

INCORP. PLANT ENGRS. (N. East). "Engineering Application of Electro-deposited Metals." J. W. Oswald. Roadway Hse, Oxford St, Newcastle, 7 p.m.

200,000 kW. in service
140,000 kW. on order
for the Greater London Area alone

For the operation of:

ELECTRIC RAILWAYS
600, 1,500 and 3,000 volts D.C.

TRAMS AND TROLLEY BUSES

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INDUSTRIAL LOADS

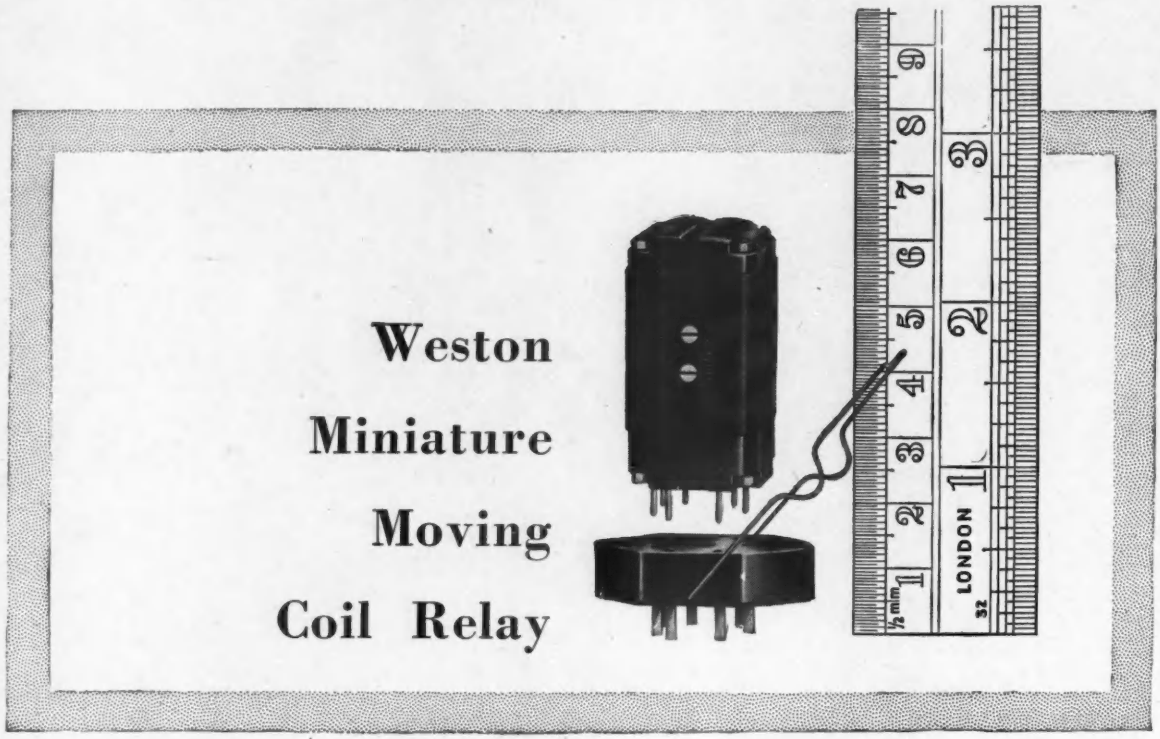
D.C. TRUCKS AND LOCOMOTIVES

FOR DOCKSIDE D.C. SUPPLY

FOR BATTERY CHARGING

Hewittic Rectifiers

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*



The "Weston" Model S.115 Miniature Moving Coil Relay functions as a sensitive "on-off" current switch, and will operate on a power input of only 5 microwatts. Generally the relay is supplied with a centre stable moving contact, but a biased version which affords a single break, or a break followed by a make, is also available. The moving coil can be provided with two windings which offer considerable scope in circuitry. The relay has a seven pin base and is supplied with a separate chassis or panel mounting socket with retaining clip: mounting position is unimportant. Size $1\frac{1}{2}$" x $\frac{3}{4}$" x $2\frac{1}{4}$", weight $1\frac{3}{4}$ oz. only. List No. W.46 gives further particulars and is available on request, but these relays give best service when they are specially designed to suit the circuit in which they are to be used, and we shall be delighted to co-operate on receipt of the pertinent information.

Other WESTON relays

MODEL S54. A relay of extreme sensitivity (size 4-1/5" x 3-1/5"). The high torque developed by the moving system ensures positive contact pressure. Leaflet — List No. W.45 gives details.

MODEL S124. A sensitive relay (size 2-3/16" x 2-3/16") with magnetic hold-on contacts having a higher rating than the other models. Leaflet — List No. W.43 gives details.

SANGAMO WESTON LIMITED

ENFIELD, MIDDLESEX · TEL: ENField 3434 (6 lines) & 1242 (6 lines) GRAMS: SANWEST, ENFIELD

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151

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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

BOROUGH OF NEWARK-ON-TRENT

GROUP "B" STREET LIGHTING

TENDERS invited for the following work in connection with the provision of Group B Lighting on certain roads in the Borough.

Section 1

Bowbridge Rd and Boundary Rd

The supply, delivery, erection and wiring of 44 No. concrete lighting columns with mounting height of 15 ft and 44 No. 150 W Tungsten lanterns.

Section 2

Shewood Ave and Beacon Hill Rd

The erection and wiring of 26 No. Stanton type 7A columns and 26 No. lanterns "Metrovick SS 51" and the supply and fixing of 26 No. 150 W Tungsten lamps.

Conditions of Contract, Specification and Forms of Tender may be obtained, and plans inspected, on application to the Borough Surveyor, Municipal Buildings, Newark, on payment of a deposit of two guineas, which will be refunded on receipt of a bona fide tender.

In tendering, separate prices must be given for sections 1 and 2 of the contract and the Council reserve the right to accept one or both of these.

Tenders in plain sealed envelopes endorsed "Group B Lighting" to be delivered to me by 23 Sept.

The Council does not undertake to accept the lowest or any tender.

J. H. M. GREAVES,
Newark-on-Trent. Town Clerk.
24 Aug., 1954. (K 837)

CITY OF BELFAST

FLUORESCENT STREET LIGHTING EQUIPMENT

TENDERS are invited for the supply, and delivery of fluorescent street lighting lanterns, brackets and concrete standards.

Form of Tender and specification (No. W.46) may be obtained at the Electricity Department, East Bridge St, Belfast, on payment of a deposit of two guineas which will be refunded provided a bona fide Tender is lodged and not withdrawn. Extra copies may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each Tender, in sealed envelope marked "Tender for Fluorescent Street Lighting Equipment Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 24 Sept., 1954.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any Tender will not necessarily be accepted.

JOHN DUNLOP,
City Hall, Belfast. Town Clerk.
P.O. Box 234.
26 Aug., 1954. (K 890)

BOROUGH OF THETFORD

STREET LIGHTING—THETFORD

TENDERS are invited for the supply and installation of 36 Concrete Street Lighting Columns, Group "A" standard, with sodium discharge lamps, lanterns and all auxillary equipment in connection with the street lighting of the Trunk Road A.11 in Thetford.

Tenders may be submitted for supply of equipment only, installation only or supply and installation.

The Specification, Bill of Quantities and Forms of Tender may be obtained from the Borough Surveyor, Municipal Offices, Thetford, Norfolk, on payment of one guinea, which will be refunded upon receipt of a bona fide Tender and return of all documents.

Plans and General Conditions of Contract may be inspected at the Municipal Offices, Thetford.

Tenders, in plain sealed envelopes, endorsed "Street Lighting Trunk Road A.11," must be delivered to the undersigned not later than noon on 30 Sept., 1954.

W. ELLIS CLARKE,
Municipal Offices, Town Clerk.
Thetford.
18 Aug., 1954. (K 787)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

TENDERS are invited for the Supply, Erection and Commissioning at Carolina Port Generating Station, Dundee, of the following:

One Steam Turbine-driven boiler feed pump and One Electrically-driven boiler feed pump for supplying two new 680 P.S.I. 150,000 lb/hr Steam Generating Units.

Tender documents and drawings may be obtained on application to the undersigned on payment of Two Guineas which will be refunded on receipt of a bona fide Tender (which is not subsequently withdrawn) and the return of all documents.

Tenders should be delivered to the undersigned, together with all technical information required, in a sealed registered package marked "Confidential," not later than 12 noon on Monday, 22 Nov., 1954.

The Board do not bind themselves to accept the lowest or any Tender.

P. PHILIP, M.I.MECH.E., M.I.E.E.,
7 Dudhope Crescent Rd, Area Manager.
Dundee.
Aug. 1954. (K 891)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

TECHNICAL INSTRUCTOR (ELECTRICAL INSTALLATION)

required for NIGERIA, etc. This appeared in 26 Aug. issue (K 811) as "Technical Assistant" and should have read as above, "Technical Instructor."

ELECTRICITY AUTHORITY OF CYPRUS

RESIDENT ELECTRICAL ENGINEER

APPLICATIONS are invited for the appointment of a Resident Electrical Engineer to supervise the construction by contractors of extensions to the Authority's 66 kV and 11 kV transmission network.

Candidates should be Corporate Members of the Institution of Electrical Engineers or hold qualifications exempting them from the Institution examination and must have had considerable experience in the construction of H.T. overhead lines up to 66,000 V.

The appointment will be at a salary of £1,250 per annum plus a cost of living allowance the present level of which is 15%.

Free quarters with heavy furniture, or an allowance in lieu, will be provided by the Authority.

The appointment will be for a period of 3 years terminable by three months' notice on either side.

Free first class passages will be provided for the officer and his family up to three full passages, on first appointment, on termination of the agreement and for long leave in the United Kingdom.

Home leave on full pay is earned at the rate of 2½ days per month of residence in service.

Applications endorsed "Resident Electrical Engineer, Cyprus," stating age, qualifications and experience, should be forwarded within 14 days of the date of this advertisement to the undersigned who will communicate with candidates selected for further consideration.

PREECE, CARDEW AND RIDER,
8-12 Queen Anne's Gate,
Westminster, S.W.1. (K 828)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following vacancies:

THIRD ASSISTANT ENGINEER (COMMERCIAL)
CHILTERNS SUB-AREA HEADQUARTERS, BEDFORD
130/54.N

Candidates should have had a good general and technical education with experience in Industrial and Commercial Power Sales Development. A competent knowledge of tariffs, thermal storage space heating and street lighting is essential. Membership of the Institution of Electrical Engineers will be an advantage.

Salary in accordance with Class L, Grade 10 of the National Joint Board Salary Agreement commencing at £766.

Apply to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford.

Previously advertised in July 1954 under reference number 100/54N. Applications submitted then will automatically be reconsidered.

GENERAL ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)
SUFFOLK SUB-AREA HEADQUARTERS, FINBOROUGH HALL, STOWMARKET
129/54.N

Candidates should have had a sound technical training and some experience in planning and estimating for high voltage and low voltage distribution systems (including substations) up to 33 kV.

Salary in accordance with Class J, Grade 13 of the National Joint Board Salary Agreement commencing at £552.

Apply to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk.

Future salaries and conditions of service for both these appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. (K 874)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for post (*a*) and Corporate Membership for posts (*b*) an advantage.

Vacancy No. 54/714

(*a*) STATION SHIFT CONTROL ENGINEER ST. MARYLEBONE GENERATING STATION

Practical experience in Control Room Operation necessary. Salary—Class E, Grade 10=£582. 15s. p.a.

Vacancy No. 54/715

(*b*) MAINTENANCE ENGINEER (MECHANICAL) WOOLWICH GENERATING STATION

Experience in the maintenance of modern generating plant is essential. Duties will include maintenance work covering mechanical plant in the boiler house, turbine house, coal handling plant, etc. Knowledge of negotiating and advisory machinery desirable. Salary—Class G, Grade 6=£826. 7s. p.a.

Vacancy No. 54/716

(*b*) THIRD ASSISTANT ENGINEER (GENERATION OPERATION DEPT.) DIVISIONAL HEADQUARTERS

Applicants should have a good technical education to the standard required for associate membership of the I.E.E. or I.Mech.E. together with some knowledge of power station operation and associated statistics. The successful candidate will be required to prepare concise reports on the salient features of power station operation and to investigate technical, economic and allied problems arising from power station operation. Salary—Class AX/EX, Grade 5=£681. 9s./£927. 3s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box No. 136, Generation House, Great Portland St. W.1, and be received within 14 days of this advertisement. (K 866)

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments subject to N.J.B. Agreement for Electricity Supply Industry:

Area Board Headquarters

GENERAL ASSISTANT ENGINEER. Chief Engineer's Department, Operation and Maintenance Section. System Protection Subsection, with location at Area Board Headquarters, Newcastle upon Tyne. Applicants must possess Higher National Certificate in Electrical Engineering or its equivalent.

Experience in testing, commissioning and maintenance of high voltage protection equipment an advantage. Salary Schedule "C," Grade 8, £501/£694.

Wear Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER, Crook District. Salary Schedule "A." Class "D," Grade 7, £635/£643.

Applications stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, GPO Box 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (K 835)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER required in the Northwich District. Salary £587/£600 per annum (N.J.B. Class E, Grade 9). The appointment is superannuable and subject to medical examination.

Applicants should have had experience in H.T. and L.T. Overhead and Underground Distribution work, and preferably have the technical qualifications to enable them to become Chartered Electrical Engineers. Successful applicants may be required to undertake standby duties.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, Nr. Northwich, Cheshire. Closing date 13 Sept., 1954. (K 854)

CITY OF SALISBURY
Southern Rhodesia

VACANCY FOR ELECTRICIAN

APPLICATIONS are invited from suitably qualified persons for the vacancy of Electrician in the Test Department.

The successful applicant must be capable of carrying out all work on electrical street traffic control equipment, and experience in general electrical work in a Test Room will be considered an advantage.

The commencing rate will be determined with regard to qualifications and experience, but will not exceed 8s. 0d. per hour for a 48 hour week.

The successful candidate must be able to comply with the requirements of the Rhodesian Immigration Authorities, and will be required to submit a satisfactory medical certificate of fitness. Details of the Council's Service and Leave Regulations will be forwarded on application.

Applicants are requested to submit full particulars of their qualifications, training and experience, giving details of positions held, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be attached.

Canvassing directly or indirectly will be a disqualification.

Applications must reach the offices of the undersigned on or before Saturday, 18 Sept., 1954.

Airmail paper should be used.

DAVIS and SOPER, LTD.,
52 and 54 St. Mary Axe,
London, E.C.3.
Agents to the City Council of Salisbury.
25 Aug., 1954. (K 769)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

FIRST ASSISTANT CHEMIST LONGFORD POWER STATION, COVENTRY

Vacancy No. 134/54/ET

Applicants should have had practical experience in all branches of Power Station chemistry. Preference will be given to candidates possessing Higher National Certificate in Chemistry or equivalent qualifications.

Salary for the above appointment will be within Class G, Grade 9 (£641/£667 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 15 Sept., 1954.

THIRD ASSISTANT ENGINEER TESTING AND EFFICIENCY SECTION, DIVISIONAL HEADQUARTERS

Vacancy No. 135/54/ET

Applicants should have a good General and Technical Education to Higher National Certificate standard, workshop experience, and a thorough knowledge and experience of Operation and Testing of modern steam Generating Plant, including Instrumentation.

Preference will be given to candidates possessing an Engineering degree, Membership of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, and specialised knowledge of Boilers and Associated Plant.

Salary will be within Schedule C, Class AX/DX, Grade 5 (£649/£858 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 15 Sept., 1954.

GENERAL ASSISTANT ENGINEER TESTING AND EFFICIENCY SECTION, DIVISIONAL HEADQUARTERS

Vacancy No. 136/54/ET

Applicants should have a good General and Technical Education to Higher National Certificate standard, workshop experience, and a good knowledge and experience of the Operation and Testing of modern steam Generating Plant, including Instrumentation and Automatic Control Systems, production of Reports and Records.

Salary will be within Schedule C, Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 15 Sept., 1954.

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SECOND ASSISTANT ENGINEER GENERATION (OPERATION)

Vacancy No. 137/54/ET

Applications are invited from suitably qualified engineers for the above position on the staff of the Generation Engineer (Operation) Northern Group, located at Nottingham.

Applicants should have served a recognised engineering apprenticeship and technical qualifications to at least Higher National Certificate standard are desirable. Experience subsequent to training must include Power Station Operation and Maintenance, preferably in a responsible position.

Salary will be in accordance with the National Joint Board Agreement, Schedule C, Class AX/DX, Grade 2 (£834/£1,053 per annum).

Closing date for receipt of applications 15 Sept., 1954.

DRAUGHTSMAN TRANSMISSION DEPARTMENT, DIVISIONAL HEADQUARTERS

Vacancy No. 140/54/ET

A Draughtsman is required in the Transmission Department at this Divisional Headquarters. Experience on the design and construction of H.V. Substations or overhead transmission lines an advantage.

Salary in accordance with Schedule D of the National Joint Board Agreement, Grade 6 (£433/£567 per annum) for Engineering Draughtsman or Grade 5 (567/£671 per annum) for Senior Draughtsman, according to experience and ability.

Closing date for receipt of applications 21 Sept., 1954.

GENERAL ASSISTANT ENGINEER TECHNICAL DEPARTMENT, DIVISIONAL HEADQUARTERS

Vacancy No. 139/54/ET

The minimum technical qualification required is the Higher National Certificate in Electrical Engineering. Preference will be given to candidates who have completed a recognised post graduate apprenticeship, and experience of High Voltage Switchgear and Protective Gear will be an advantage.

The successful candidate will be required to reside in or near Leicester.

The salary will be in accordance with Schedule C, Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement. The commencing salary will depend on qualifications and experience.

Closing date for receipt of applications 21 Sept., 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
27 Aug., 1954. (K 878)

MIDLANDS ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (Industrial) required in the Sutton Coldfield and North East Birmingham District of the Birmingham and District Sub-Area.

Duties involve advising consumers on most suitable electrical equipment for their purpose and will include control of an industrial showroom. Experience necessary in applications of electricity for industrial uses. Technical qualifications desirable. Salary £764/£796 per annum (N.J.B. Grade J8). Superannuable.

Applications, within 14 days, stating age, qualifications, experience and present salary, endorsed "Second Assistant District Commercial Engineer," to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

A STEPHENS,
Secretary.
(K 870)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER (ASSISTANT SERVICE ENGINEER) BOLTON DISTRICT

APPLICANTS must have had experience of all classes of electrical installation work and be capable of drawing up estimates of materials and labour costs: They should also have experience of the maintenance of domestic appliances. The possession of some qualification in electrical engineering or electrical installation work would be an advantage.

Salary Scale: £573/£596 p.a. Grade G.11. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 11 Sept., 1954.

APPOINTMENT OF SENIOR ASSISTANT ENGINEER (TESTING), SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM

Applicants should be well qualified engineers with experience in the following:

Administration and control of a large testing station including the calibration, testing and installation of all types of meters and associated equipment, testing of protective gear and the maintenance of telecommunication systems.

Salary: £1,093/£1,141 p.a. Grade K.4. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 11 Sept., 1954.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (SYSTEM PLANNING) SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, PRESTON

Applicants should be experienced in planning and estimating for extensions to overhead and underground systems, substation design and network calculations, for systems up to 33 kV including some knowledge of protective equipment.

Preference will be given to applicants who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary Scale: £926/£966 p.a. Grade L.7. N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 11 Sept., 1954. (K 824)

NORTH STAFFORDSHIRE TECHNICAL COLLEGE

(Stoke-on-Trent)

PRINCIPAL: H. W. WEBB, O.B.E., D.SC.

APPLICATIONS are invited for the appointment of a full-time ASSISTANT LECTURER (Grade "B") in Electrical Engineering. Candidates should preferably possess either a degree or a Higher National Certificate.

Salary according to the Burnham Technical Scale, which is now under review. The present salary is £490 x £25 to £765, with full allowances for training, graduate qualifications and industrial experience.

Applications giving details of qualifications and experience should be sent to the Principal immediately.

H. DIBDEN,
Clerk to the Governors.
(K 832)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

FITTER (ELECTRICAL), HERTFORD DISTRICT
128/54R

CANDIDATES should be experienced in the erection and maintenance of switchgear up to 33 kV.

The rate of pay, at present 3s. 9d. per hour, for a 44-hour week, and conditions of service will be in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry.

Applications by letter stating age, education and experience with details of present duties, should be submitted to the District Manager, Eastern Electricity Board, Northmet Sub-Area, Bridgefoot, Ware, Herts, within fourteen days of the appearance of this advertisement. (K 871)

HER MAJESTY'S COLONIAL SERVICE

VACANCY FOR ELECTRICAL ENGINEER, PUBLIC WORKS DEPARTMENT, TANGANYIKA

DUTIES are the design of general lighting and power installations, the supervision of the work to completion, and inspectional work under the Electricity Ordinance.

Appointment is pensionable on probation in the salary scale £655/£1,320 p.a., point of entry depending on qualifications and experience. Temporary allowance of 35% of salary (maximum £350 per annum) and outfit allowance on salaries of £840 per annum or less are also payable.

Free sea passages are provided for the officer, his wife, and each child. The sea fare shall be limited to the air fare prevailing at that time. Government quarters are provided, if available, at a rental of 10% salary. Leave is granted at the rate of six days per month of resident service.

Candidates under 40 years of age, should have passed or be exempt from Parts A and B of the examination for A.M.I.E.E., and have had at least two years' practical training.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number (BCD 112/8/015/D10). (K 877)

SOUTH WESTERN ELECTRICITY BOARD

FOREMAN LINESMAN
CENTRAL CONSTRUCTION DEPARTMENT
TAUNTON

SALARY £505 p.a. N.J.I.C. Agreement. 3 years' experience in overhead line construction including 1 year as chargehand and keeping of work records essential. Experience of underground cable laying helpful. Successful candidate required to work anywhere in South West, subsistence allowances payable away from Taunton. Application forms obtainable from Mr D. F. Horn, Central Construction Department, Priorswood Rd, Taunton, should be returned by 14 Sept. (K 880)

NORTH EASTERN GAS BOARD

(Head Office)

ELECTRICAL SUPERVISOR

APPLICATIONS are invited for the above position, the commencing salary of which will be within Grade A.P.T.12 of the National Salary Scales (£765/£890). The point of entry to be determined by qualifications and experience.

The successful candidate will be required to supervise the installation of electrical equipment and be responsible for the standard of electrical maintenance on the various works of the Board. Preference will be given to candidates of Higher National Certificate standard with a wide experience of electrical installations in large works or factories. Design ability is not essential, but a good knowledge of wiring diagrams and circuit testing, together with extensive workshop experience, is necessary.

The successful candidate will be required to pass a medical examination and to participate in the Board's Staff Pension Scheme.

Forms of application may be obtained from the Chief Engineer at the address below, and should be returned to him, together with the names of two referees, not later than 18 Sept., 1954.

J. C. GARDNER,
Secretary.
Bridge St,
Leeds, 2.
24 Aug., 1954. (K 825)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (Planning) Southern Sub-Area Headquarters. N.J.B. G.10 (£608/£630 p.a.). Candidates (preferably qualified to H.N.C. standard) should have had sound practical training and experience in construction of rural and urban systems.

Applications stating age, qualifications and experience should reach the Board at High St, Galashiels, within 14 days. (K 851)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the following positions in the Generation (Operation) Department. N.J.B. service conditions, superannuable appointments, salaries within Schedule "A" of the Agreement:

(*a*) SHIFT CHARGE ENGINEER at Hams Hall "A" Power Station, Grade J7, commencing at £817 per annum. (Vacancy No. 748MD).

(*b*) BOILER HOUSE SHIFT CHARGE ENGINEER at Nechells "B" Power Station, Grade J9, commencing at £719 per annum. (Vacancy No. 749MD.)

Applicants for these positions should have received a sound technical training and power station practical experience in the operation and maintenance of steam generating plant and main switchgear. Applicants for (*a*) should also have a thorough knowledge of pulverised fuel firing. Appropriate qualifications an advantage.

Apply, quoting the vacancy number, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 18 Sept., 1954. (K 869)

YORKSHIRE ELECTRICITY BOARD

NO. 6 (HULL) SUB-AREA
SECOND ASSISTANT ENGINEER (METERS, TESTING AND PROTECTION)

APPLICANTS should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications, have a sound technical and practical knowledge of all types of metering, including instrument technology, and be capable of supervising the work carried out in a Meter Testing Laboratory. Experience in the commissioning and maintenance of protective equipment will be an advantage.

Salary—N.J.B. Class K, Grade 7 £869/£907 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 16 Sept., 1954.

NO. 5 (WAKEFIELD) SUB-AREA
Castleford District
ASSISTANT INSTALLATION ENGINEER

Applicants must have had a sound technical education and practical experience in electrical contracting work of all types. They must be capable of preparing and supervising schemes for all classes of domestic, commercial and industrial installations, including specifications, estimates and tenders. Experience in electrical appliance repairs would be considered an advantage. Applicants must have had considerable experience in the control of workmen.

Salary—N.J.B. Class F, Grade 10, £577/£598 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Rd, Wakefield, not later than 16 Sept., 1954.

NO. 7 (GRIMSBY) SUB-AREA
Scunthorpe and Gainsborough Districts
JUNIOR ENGINEER

Applicants should hold the higher National Certificate in Electrical Engineering or an equivalent qualification. They should have had training and experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems.

Salary:

Scunthorpe District—N.J.B. Class F, Grade 15/14, £402/£466 per annum.

Gainsborough District—N.J.B. Class D, Grade 15/14, £390/£423 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby), Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 16 Sept., 1954. (K 856)

THE ELECTRICITY CORPORATION OF NIGERIA

HAS VACANCIES FOR:

(*a*) ELECTRICAL ENGINEERS

(*b*) MECHANICAL ENGINEERS

for service in Nigeria.

Corporate Members of the Institutions of Electrical and/or Mechanical Engineers are invited to apply. Applications for a limited number of vacancies will also be considered from men with good practical experience possessing the Higher National Certificate.

Commencing salaries range from £760 to £1,300 per annum according to qualifications, age and experience, plus generous Expatriation Allowance. Pensionable or Contract terms are available, the latter carrying an increase in basic pay and a gratuity at termination of service.

Free passages are provided for man and wife with assisted passages or U.K. Maintenance allowance for two Children up to 18 years of age. Furnished quarters at low rental, free medical attention, low income tax, home leave on full pay. Forms of application can be obtained from the Liaison Officer, 11 Manchester Sq, W.1. (K 879)

CITY COUNCIL OF SINGAPORE

ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the post of JUNIOR TECHNICAL ASSISTANT in the City Electricity Department on 3 years' agreement in the first instance. On satisfactory completion of the agreement the appointee would normally be offered emplacement on the permanent establishment.

Applicants must be Graduate members of the Institution of Electrical Engineers or possess the Higher National Certificate (Electrical) or equivalent. They must also have experience in Technical planning of High and Low Voltage transmission and Distribution Networks, Substations, Transformers and Switchgear, etc., and knowledge of High Voltage Generating Plant and Control equipment. Minimum age: 28 years.

The salary offered is $870, $910, $950 a month for the 1st, 2nd and 3rd year respectively in the salary scale $870 x A40-990. Expatriation and Cost of Living Allowances are also payable.

If placed on the permanent establishment after satisfactory completion of the Agreement the basic salary will be $990 per month in the scale $870 rising to $990 per month (£1,218 to £1,386 per annum).

Expatriation Allowance payable is £315 per annum on basic salary of $870 a month and £343 per annum on basic salary between $871 and $990 a month.

Cost of Living Allowance payable at present is £738 per annum on basic salary between $870 to $910 a month and £274 per annum on basic salary between $950 and $990 a month for a single man; £385 per annum on basic salary between $870 and $990 a month for a married man; £560 per annum on basic salary between $870 and $990 a month for a married man with one or more children. A dependent child means an unmarried child, including a step child or a legally adopted child, under the age of 17, or receiving full-time educational instruction and below the age of 21.

For a single man the minimum total emoluments on a basic salary of $870 a month would amount to £1,771 per annum: for a married man with no children £1,918 per annum and for a married man with one or more children £2,093 per annum.

The exchange rate is approximately $1 to 2s. 4d. sterling.

Partly furnished quarters provided if available at 6% basic salary or Housing Allowance of 10% of basic salary (subject to a maximum of $120 per month) paid in lieu.

Free passages will be provided for appointee, his wife and his own children under the age of 12 years at the date of sailing subject to a maximum of three full passages.

One month leave per year of service may be granted on satisfactory completion of agreement at the discretion of the Council.

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If placed on the permanent establishment on completion of the agreement the appointee will be required to serve a further year before proceeding on leave. The present rate of leave is 4 days per month of resident service. Local leave of 14 days a year cumulative to a maximum of 28 days may also be granted.

Compulsory Provident Fund contributions at present 7½% of salary (but not allowances) to which the Council donate 7½% rising to 10% after 10 years' service, 15% after 15 years' service, and 20% after 20 years' service. This scheme is under review.

Further details from the Council's London Agents: Messrs Allen and Williams, 1 Victoria St, Westminster, London, S.W.1. Full applications in Duplicate to be submitted before Tuesday, 14 Sept, 1954. (K 772)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SHIFT CHARGE ENGINEER is required at Ocker Hill Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A," Grade F7, £697/£718 per annum.

Applicants should have received a sound technical training and power station practical experience in the operation and maintenance of steam generating plant and main switchgear. Appropriate qualifications an advantage.

Apply, quoting vacancy No. 745MD, on Form AE6, available from Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 11 Sept., 1954.

R. L. BATLEY,
20 Aug., 1954. Divisional Controller. (K 834)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Edinburgh Sub-Area

JUNIOR ENGINEER to assist in the operation and maintenance of underground networks up to 33 kV. N.J.B. J.15 (£501 p.a.) or J.14 (£545 p.a.) according to age and experience. Superannuation. Applications stating age; qualifications, which should be not less than H.N.C. standard; training; experience; and present position, should be received within 14 days.

G. T. ALLCOCK,
Sub-Area Manager. (K 830)

FOREMAN ELECTRICIANS

TWO FOREMAN ELECTRICIANS required for service with the Sudan Light and Power Co., Ltd., in Khartoum, Sudan, as Supervisors to plan and control the activities of a number of site foremen engaged on electrical installation work in buildings and to train Sudanese personnel. Applicants must be of good general education and have served at least 5 years Indentured Apprenticeship with a reputable firm of Electrical Engineers or Contractors. They must have a thorough knowledge of Power and Lighting installations work and be fully experienced in the use of heavy gauge conduit and pyrotenax. Salary in range £E.804 to £E.1,284, according to qualifications and experience. (£E=£1. 0s. 6d.)

Appointments will be on contract for a period up to 5 years, including a period of 12 months' probation, with a bonus payable on completion of the Contractual period. A Cost of Living Allowance will be payable in addition to salary. A Kit Allowance of £E50 will be payable on appointment. Free living accommodation with basic furniture or an allowance in lieu thereof and free transport will be provided. After satisfactory completion of the probationary period liberal leave on full salary with free passages.

Applications stating age, education, qualifications, experience with particulars of posts held, present appointment and salary with names of two referees should be submitted to the Secretary, The Power and Traction Finance Company Limited, Queens House, Kingsway, London, W.C.2.

25 Aug., 1954. (K 853)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following posts:

STATION CHEMIST
EARLEY GENERATING STATION, READING
S/13.560

Applicants should be fully qualified industrial chemists with practical experience of fuel, water and oil testing. A knowledge of boiler chemistry for high steam pressures and temperatures will be an advantage.

Salary N.J.B. G/7 £729/£758.

JUNIOR ENGINEERS
S/13.561

Applicants should have had an apprenticeship or practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a higher national certificate (or those awaiting results of H.N.C. examinations).

The duties of those appointed will vary, but will include as a general rule, the operation and control, under supervision, of generating plant.

Vacancies also exist for those who wish to specialise in the maintenance of electrical and mechanical generating plant or in generating station construction work.

Salary N.J.B., £402/£556, depending on qualifications, experience and position to which appointed.

Special application forms for each of the above posts, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 15 Sept., 1954. (K 873)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

FARM SALES REPRESENTATIVE, Berwick District. N.J.C. Grade 2 (£485/£545 p.a.). Candidates should have experience in the applications of electricity in farm and garden, and general electrical and farming background knowledge.

Applications stating age, qualifications and experience should reach the Board at High St, Galashiels, within 14 days. (K 852)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

(1) DISTRICT COMMERCIAL OFFICER in the Southport District. Salary £803/£834 p.a. (N.J.B. Grade 4, Class E). Application forms obtainable on written request from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool, 3.

(2) DISTRICT COMMERCIAL OFFICER in the North Wirral District. Salary £971/£1,014 p.a. (N.J.B. Grade 3, Class G). Application forms obtainable on written request from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester.

Applicants should preferably be Chartered Electrical Engineers, and have had experience in the preparation of technical schemes and estimates, contracting, sale of appliances, supervision of service centres and dealing with consumers' enquiries. Closing date: 10 Sept., 1954. (K 826)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

ASSISTANT SECTION ENGINEER (Transmission) required for Edinburgh (Currie) Section.

Applicants must have had experience in maintenance of 132 kV transmission lines, cables and substation equipment, and possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary £584/£745 (N.J.B. Class AX/BX/6). Pension scheme. No car allowance. Transport provided.

Apply in writing by 18 Sept., 1954, stating age, qualifications and experience to Divisional Controller, British Electricity Hse, Portobello, Midlothian. (K 876)

BRITISH ELECTRICITY AUTHORITY
South East Scotland Division

GENERAL ASSISTANT ENGINEER required in the "Protective Gear and General Section" of the Technical Department at Divisional Headquarters, Portobello.

Applicants should possess qualifications leading to Associate Membership of the I.E.E. and have experience in the design, manufacture and commissioning of switchgear and protective gear. Knowledge of Transformers and Alternators an advantage.

Salary scale £501/£656 per annum (N.J.B. Class AX/BX/8). Placing according to experience. Pension scheme.

Apply in writing by 18 Sept., 1954, to Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity Hse, Portobello, Midlothian. (K 875)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED FIRST ASSISTANT DISTRICT ENGINEER in Districts 101/102 (Haverfordwest) in the Western Sub-Area.

Applicants should have experience in the construction, operation and maintenance of substations, underground and overhead, high and low voltage mains in urban and rural areas.

Salary—Class D, Grade 4 (£746/£765/£784) of the N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 11 Sept., 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (K 881)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Commercial) Southern Sub-Area Headquarters. N.J.B. G.7 (£729/758 p.a.) Candidates (preferably qualified to H.N.C. standard) should have sound experience of electrical contracting, including preparation of specifications and tenders, and knowledge of I.E.E. and Factory Regulations.

Applications stating age, qualifications and experience should reach the Board at High St, Galashiels, within 14 days. (K 850)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following post:

JUNIOR ENGINEER
Norwich Generating Station

Salary Class F/15, £402—Class F/14 £466 per annum.

The duties of the successful applicant will include assisting in the Control Room on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 11 Sept., 1954.

W. N. C. CLINCH,
Controller. (K 855)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

FIRST ASSISTANT CHEMIST
LONGFORD POWER STATION, COVENTRY
Vacancy No. 134/54

Applicants should have had practical experience in all branches of Power Station chemistry. Preference will be given to candidates possessing Higher National Certificate in Chemistry or equivalent qualifications.

Salary for the above appointment will be within Class G, Grade 9 (£641/£667 per annum) of the National Joint Board Agreement.

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Closing date for receipt of applications: 15 Sept. 1954.

THIRD ASSISTANT ENGINEER, TESTING AND EFFICIENCY SECTION, GEN. (O), DIVISIONAL H.Q.
Vacancy No. 135/54

Applicants should have a good General and Technical Education to Higher National Certificate standard, workshop experience, and a thorough knowledge and experience of operation and testing of modern steam generating plant, including instrumentation.

Preference will be given to candidates possessing an Engineering Degree, Membership of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, and specialised knowledge of boilers and associated plant.

Salary will be within Schedule C, Class AX/DX, Grade 5 (£649/£858 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 15 Sept. 1954.

GENERAL ASSISTANT ENGINEER, TESTING AND EFFICIENCY SECTION, GEN. (O), DIVISIONAL H.Q.
Vacancy No. 136/54

Applicants should have a good General and Technical Education to Higher National Certificate standard, workshop experience, and a good knowledge and experience of the operation and testing of modern steam generating plant, including instrumentation and automatic control systems, production of Reports and Records.

Salary will be within Schedule C, Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 15 Sept. 1954.

SECOND ASSISTANT ENGINEER, GENERATION (OPERATION)
Vacancy No. 137/54

Applications are invited from suitably qualified engineers for the above position on the staff of the Generation Engineer (Operation) Northern Group, located at Nottingham.

Applicants should have served a recognised engineering apprenticeship and technical qualfications to at least Higher National Certificate standard are desirable. Experience subsequent to training must include power station operation and maintenance, preferably in a responsible position.

Salary will be in accordance with the National Joint Board Agreement, Schedule C, Class AX/DX, Grade 2 (£834/£1,053 per annum).

Closing date for receipt of applications: 15 Sept. 1954.

The above appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy No.

L. F. JEFFREY,
Divisional Controller.
20.8.54. (K 833)

SOUTHERN ELECTRICITY BOARD
INSTALLATION ASSISTANT

YEOVIL District, No. 4 (Bournemouth) Sub-Area. N.J.B. Class F, Grade 11, Column 1 (£548 per annum). N.J.B. Conditions of Service.

Applicants should have had sound experience in the preparation of specifications and estimates for all types of electrical wiring installations, and should be competent to supervise Electricians and organise the allocation of work.

The successful candidate for the above appointment will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him in envelopes suitably endorsed, not later than 18 Sept., 1954. (K 883)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

SOUTH EAST SCOTLAND ELECTRICITY BOARD
Fife Sub Area

SENIOR ASSISTANT ENGINEER (PLANNING)

CANDIDATES should preferably be Graduates of the Institution of Electrical Engineers, or hold equivalent qualifications; have a sound engineering training; and be experienced in electricity supply work, particularly the planning and development of overhead and underground distribution systems up to 33 kV including rural networks. N.J.B. G.4 (£905/£944 p.a.). Superannuation. Rented house may be available.

Applications, giving full details of training, experience and qualifications, should be submitted within 14 days.

C. H. A. COLLYNS,
East Port, Sub-Area Manager.
Dunfermline, Fife. (K 831)

BRITISH ELECTRICITY AUTHORITY
South-Eastern Division

ASSISTANT ENGINEER (Works Office Co-ordination) — Littlebrook Power Station. This post offers opportunity for progress for a person having foresight and initiative and who can effectively co-ordinate the operation and maintenance activities of a modern power station. Applicants should have had experience of both these activities and membership of either the Institute of Mechanical or Electrical Engineers would be an advantage. N.J.B. conditions of service and salary Class M, Grade 8, £968. 2s. per annum, including London Allowance. Written applications giving details of education, present position, experience, etc., should be received by Station Superintendent, Littlebrook Power Station, Nr. Dartford, Kent, by 11 Sept. (K 838)

SOUTH EASTERN ELECTRICITY BOARD
FIRST ASSISTANT DISTRICT ENGINEER
Crawley District

SALARY £675/£701 p.a. under N.J.B. C.5. Superannuable. Applicants should be qualified and have experience in the construction, operation and maintenance of overhead and underground systems up to 33 kV. Duties will involve standby. (Applicants who replied to the previous advertisement for this appointment need not re-apply as their previous application will be considered.)

Applications, naming 2 referees, to F. A. Avery, A.I.E.E., District Manager, SEEBoard, 55 High St, Crawley, Sussex, by 15 Sept., 1954.

A. L. BURNELL,
Secretary.
August, 1954. (K 882)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Northern Area

APPLICATIONS are invited for the post of COMMERCIAL ASSISTANT operating from the Area Office, Dingwall, Ross-shire.

Applicants must have had experience in the preparation of estimates and should be familiar with all types of domestic electrical equipment and stores control. Must have initiative and be capable of sales promotion throughout a Rural Area.

Salary will be in accordance with N.J.C. Scale 2—£485 x £20—£545 per annum.

Application form may be obtained from Area Manager, Church St, Dingwall, Rossshire, and should be returned within fourteen days. (K 827)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 87/54

APPLICATIONS invited for superannuable N.J.B. appointment of ASSISTANT ENGINEER (Combustion and Efficiency) Llynfi Power Station. Salary G.9, £641/£667 per annum.

Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Previous experience with large pulverised fuel boilers and Bailey Automatic combustion control desirable.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 17 Sept., 1954. (K 872)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Design and Planning Branch of the North Western Sub-Area in Central London.

Applicants should have had a good general and technical education in electrical engineering and building construction, and experience in a mains record office dealing with systems of all voltages up to 11 kV.

The post is graded under Schedule "D" of the National Joint Board agreement as Grade 6—£458 to £595. 7s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed by 9 Sept., 1954. Please enclose addressed envelope and quote ref.: V/1804/T on envelope and all correspondence. (K 829)

NORTH EASTERN ELECTRICITY BOARD

Tyne Sub-Area

APPLICATIONS are invited for the appointment of DISTRICT ENGINEER, Hexham District, Northumberland. Duties will include the control of the district engineering staffs and responsibility for the construction, operation and maintenance of the district E.V. and L.V. distribution systems (overhead and underground).

Salary Schedule "A," Class "D," Grade 3—£813/£843. N.J.B. conditions of service.

Applications from technically qualified engineers stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (K 836)

ALKALINE BATTERIES LTD., of Redditch, are the largest makers in the Empire of Alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its Technical Sales and Development Sections for Graduate ELECTRICAL ENGINEERS, not over 30 years of age, or for men nearing the end of their Degree Course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed to Commercial Manager, Alkaline Batteries Ltd., Union St, Redditch. (K 23)

BRITISH ELECTRICITY AUTHORITY, Headquarters, London, require a SENIOR ASSISTANT ENGINEER (Cooling Towers) in the Generation Plant Design Sub-Branch. Duties will consist of investigations into the technical and economic aspects of cooling tower design, leading to the development of specifications and to critical assessment of the technical features and performance of specific designs.

Candidates should preferably hold an Honours Degree in Engineering and/or be Corporate Members of either the Inst.C.E. or the I.Mech.E. Experience in either a civil engineering or cooling tower design office is desirable. Salary N.J.B. Grade 1, £1,002 to £1,378 inclusive. Applications stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 21 Sept., 1954. Quote Ref. ET/512. (K 858)

BRUSH ELECTRICAL ENGINEERING CO., LTD., Loughborough, Leics, has a vacancy for a RESEARCH ENGINEER to assist with projects connected with high voltage technology and the development of power transformers. A good Degree in Electrical Engineering or Physics is necessary with experience of transformer design, manufacture, or associated techniques. Consideration will be given to candidates with suitable educational qualifications and experience of research in kindred fields who wish to develop further knowledge and experience in this important work. Existing facilities provide opportunities for original research. Please write with full details to the Chief Personnel Officer. (K 849)

BRITISH ELECTRICITY AUTHORITY, Headquarters, London, require a 3RD ASSISTANT ENGINEER (Boiler Plant) in the Generation Plant Design Sub-Branch. Duties will be to assist in technical investigations in relation to boiler plant, with particular reference to combustion, heat transfer, circulation and stressing problems, and in the preparation of specifications. Candidates should preferably have a degree in Mechanical Engineering or equivalent qualification and experience in the manufacture of major items of power station mechanical plant, preferably those associated with boilers. Salary N.J.B. Grade 4, £753/£981 p.a. inclusive. Forms from D. Moffat, Director of Establishments, Winsley St, London, W.1, to be completed and returned by 20 Sept., 1954. Quote Ref. ET/513. (K 862)

BRITISH ELECTRICITY AUTHORITY, (South Western Division), require a GENERATION ENGINEER (Operation) based at Plymouth. Candidates should preferably be Corporate Members of one or more of the recognised Engineering Institutions and be familiar with the operation of modern H.P. plant.

Salary within N.J.M. Scale 5, £1,750/£1,900.

Applications stating age, present position and salary, and giving full details of qualifications and experience, to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 20 Sept., 1954. Quote Ref. ET/515. (K 839)

DESIGN ENGINEER for Power Rectifiers is required by a large manufacturing organisation in the Midlands, for work of exceptional interest with good prospects. No previous rectifier experience is necessary, but candidates should have Degree or good H.N.C., and some practical training. Excellent residential and educational district. Please write with full details to Box No. 1323, T and G., 167 High Holborn, London, W.C.1. (K 819)

DESIGN DRAUGHTSMAN required with good drawing office experience preferably on domestic electrical appliances. The post provides excellent scope for initiative and advancement. Applications in confidence, to be addressed to Mr D. Hutton, British National Electrics Ltd., Newarthill, Nr. Motherwell, Scotland. (K 840)

DESIGNER required by small progressive company of Electrical Engineers, East London, for Design and Development of Light Electrical and Mechanical Apparatus and Industrial Resistance Heating Equipment. This is an opening leading to a top executive position. Applicants must be able to work on their own initiative and to control small drawing office. Write in strictest confidence giving full details of past experience, age, qualifications and salary received for each of past 5 years to—Box No. 3797, Electrical Times. (K 868)

ELECTRICAL DRAUGHTSMAN required by the Steel Company of Wales Limited (Steel Division), Port Talbot.

Candidates should have experience in heavy industry and be capable of preparing drawings for electrical installation work, schematic diagrams, etc. A knowledge of lighting and communications would be an advantage.

Higher National Certificate or equivalent desirable.

Permanent and pensionable positions offered to suitable men with rates varying with age and qualifications.

Those wishing to apply should send full particulars of age, qualifications, experience, etc., to the Personnel Superintendent, The Steel Company of Wales Limited, P.O. Box No. 3, Port Talbot, Glam. (K 842)

ELECTRICAL RESEARCH ASSISTANT. A large organisation in the North-West wishes to appoint a young man to evaluate the electrical properties of new insulation products.

Possession of Higher National Certificate in Electrical Engineering is desirable. Apply to—Box No. 3787, Electrical Times. (K 843)

ELECTRICAL ENGINEER required (aged 30-40, preferably Chartered), to assume leading position — commanding equivalent £1,000 p.a. to start—in Design Office of London Company. Applicants must be fully conversant with low and medium voltage automatic contactor gear, motors, relay systems, and methods of temperature control. Previous D.O. experience and a thorough knowledge of wiring systems applied to precision machinery is essential. Write in first instance: Personnel Manager, Molins Machine Co., Ltd., Evelyn St, London, S.E.8. (K 885)

ELECTRICAL Cable Manufacturers, Manchester area, require an ASSISTANT in their Testing and Quality Control Dept. Knowledge of both rubber and plastic technology is absolutely essential. Permanent pensionable position, apply giving full details of experience, salary, age, etc.—Box No. 3791, Electrical Times. (K 846)

ELECTRICAL Cable Manufacturers, Manchester area, require an ASSISTANT FOREMAN for their Extruding Dept. Knowledge of both rubber and plastic technology is absolutely essential. Permanent pensionable position, apply giving full details of experience, salary, age, etc.—Box No. 3793, Electrical Times. (K 847)

FOREMAN ELECTRICIAN required for Hydro-Electric Scheme in Perthshire; chiefly for maintenance work. Must have extensive experience of large Public Works Contracts including 3,300 V H/T distribution. Apply giving details of previous experience to The Cementation Co., Ltd., Killin, Perthshire. (K 884)

FULL TIME REPRESENTATIVE required by leading manufacturers in switch and thermostat field for Northern Counties Area. Contact with Electricity Boards and leading industrial organisations necessary. Reply with full details of experience and remuneration expected to—Box No. 3769, Electrical Times. (K 759)

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LTD., Walton-on-Thames, Surrey, require experienced ENGINEERS for their Transformer and/or Rectifier Estimating Departments. Applications to be made in writing giving full details. (K 765)

JUNIOR AND SENIOR DETAIL DRAUGHTSMEN with shop experience and design knowledge for work on light steel structures in London. 5 day week. Pension Fund. Apply in writing stating age, experience, qualifications and salary required to Staff Officer, British Insulated Callender's Construction Company, Ltd., P.O. Box No. 108, 30 Leicester Square, London, W.C.2. When replying to this advertisement please quote Ref. No. C/49/54. (K 886)

LAYOUT DRAUGHTSMAN required by Consulting Engineers for electrical layout work including HV and LV outdoor substations, indoor switchgear and cable diagrams.

Applicants should possess or should be studying for H.N.C. or equivalent. Salary in accordance with qualifications. Apply in writing reference KJB/RFS to Messrs Kennedy and Donkin, 12 Caxton St, Westminster, London, S.W.1. (K 776)

MAJOR Oil Company requires one ELECTRICAL ENGINEERING DRAUGHTSMAN for work in the Middle East. Age 25-30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualifications. An engineering apprenticeship is required which includes 3 years' practical experience in the shops followed by 3-5 years in the Drawing Office on electrical installations for Process Plants, Workshops and/or Factories. Overseas allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension Scheme. Write, stating age and full details of qualifications, quoting F.500 to Box 1220, c/o 191 Gresham Hse, E.C.2. (K 863)

MERZ AND McLELLAN, Consulting Engineers, invite applications for ELECTRICAL ENGINEERS to supervise the testing and commissioning of alternators, transformers, switchgear, control equipment and protective gear, in various parts of Great Britain. Applicants should hold an engineering degree and have undergone a student or apprentice course at the works of one of the major Contractors for electrical plant and equipment. They should have obtained practical works experience and experience in site testing and commissioning equipment at all voltages up to and including 132 kilovolts. Salary according to age, qualifications and experience. Staff pension scheme. Apply stating age, education, training, qualifications, Institution membership, experience and salary required to Merz and McLellan, Milburn, Esher, Surrey. (K 783)

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Please reply stating age, qualifications and salary, to the Group Training and Personnel Officer, Metal Industries Ltd., Universal House, 60 Buckingham Palace Rd, London, S.W.1. (K 865)

SALES ENGINEER required by Mersey Cable Works Limited, Linacre Lane, Bootle, Liverpool 20, for North-East England. Applicants should be between 35/45 and will be required to reside in the Newcastle Area. Previous experience in the Electric Cable Industry is desirable preferably with Rubber and Thermoplastic Cables. Salary will be in accordance with experience and qualifications and the appointment qualifies for the Tube Investments Pension Scheme. Applications in writing should be addressed to The Secretary. (K 861)

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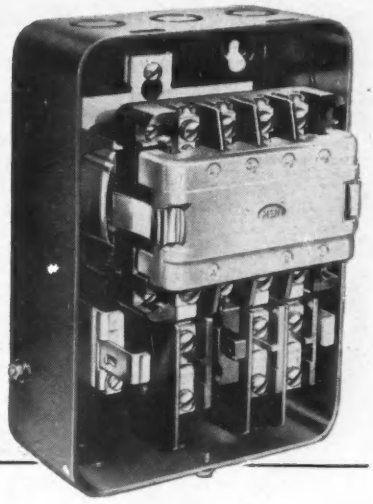

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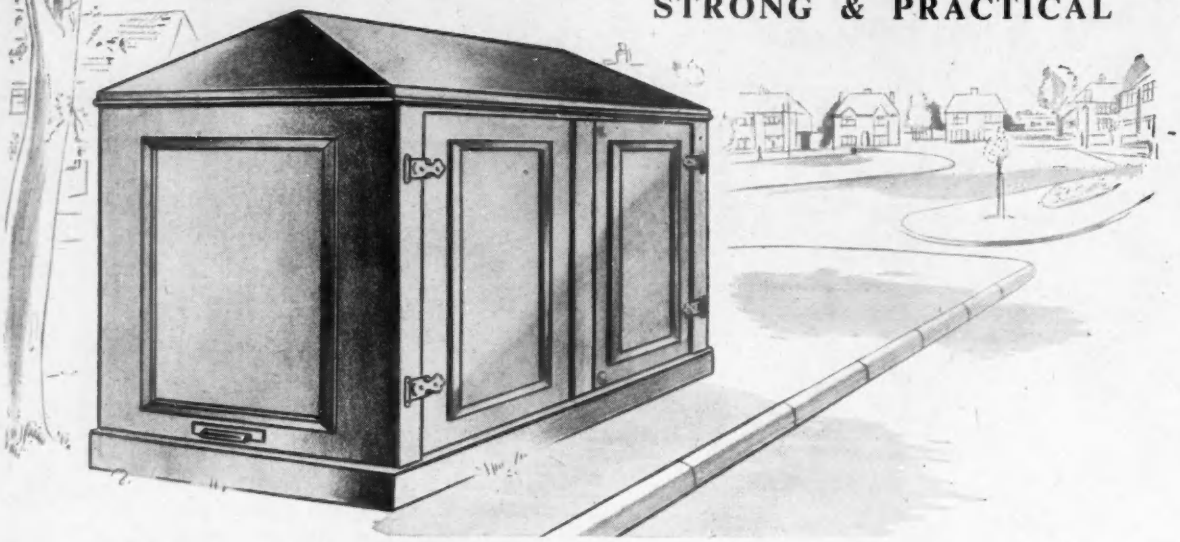

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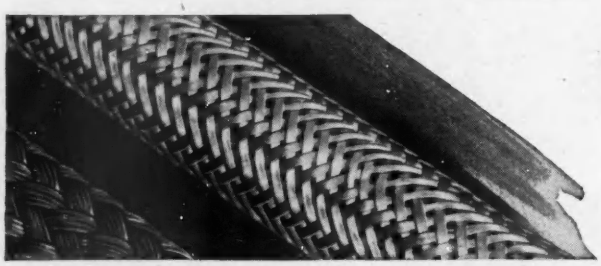

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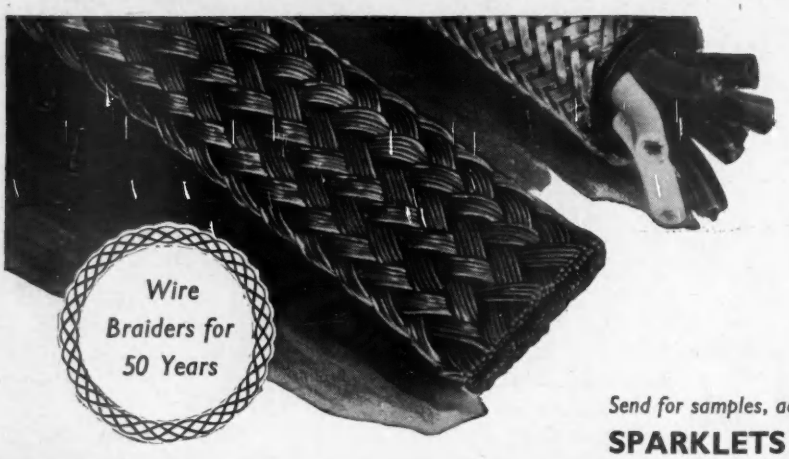

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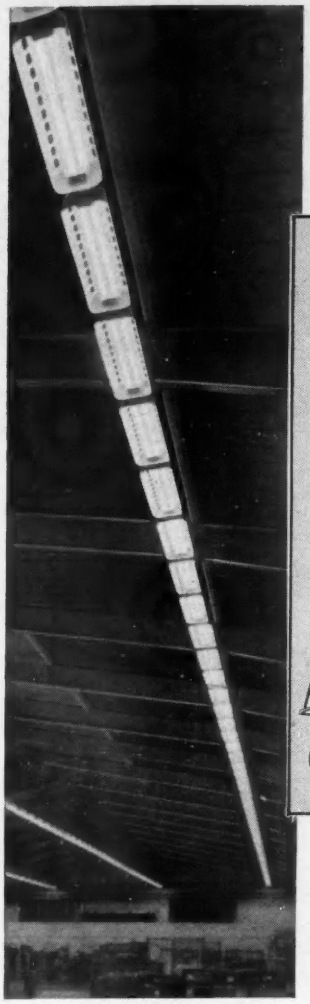

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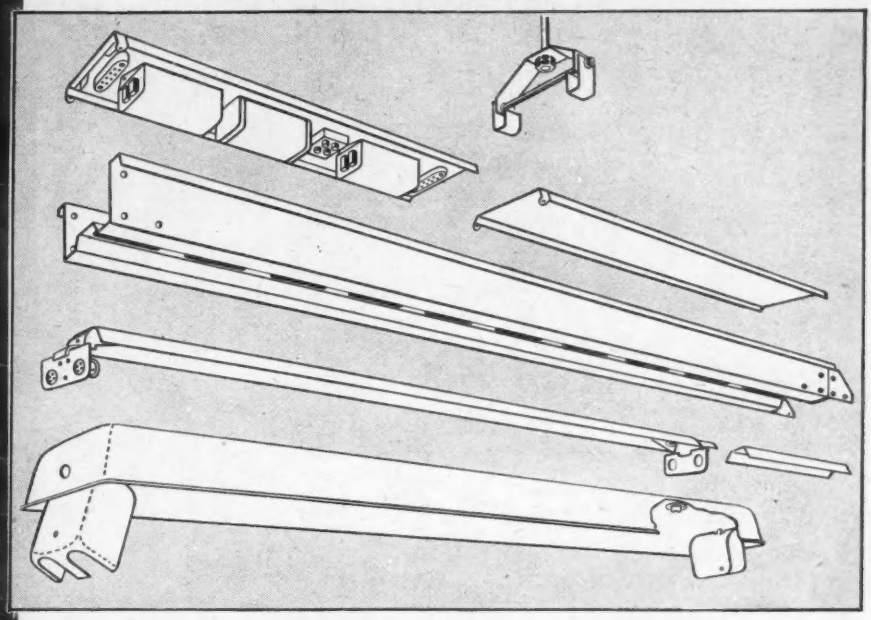

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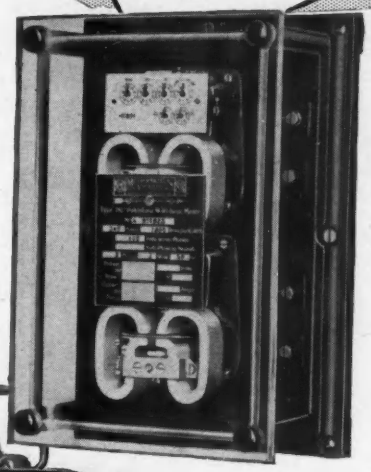

Full switchboard Pattern

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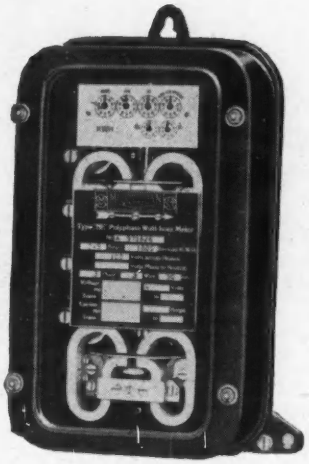

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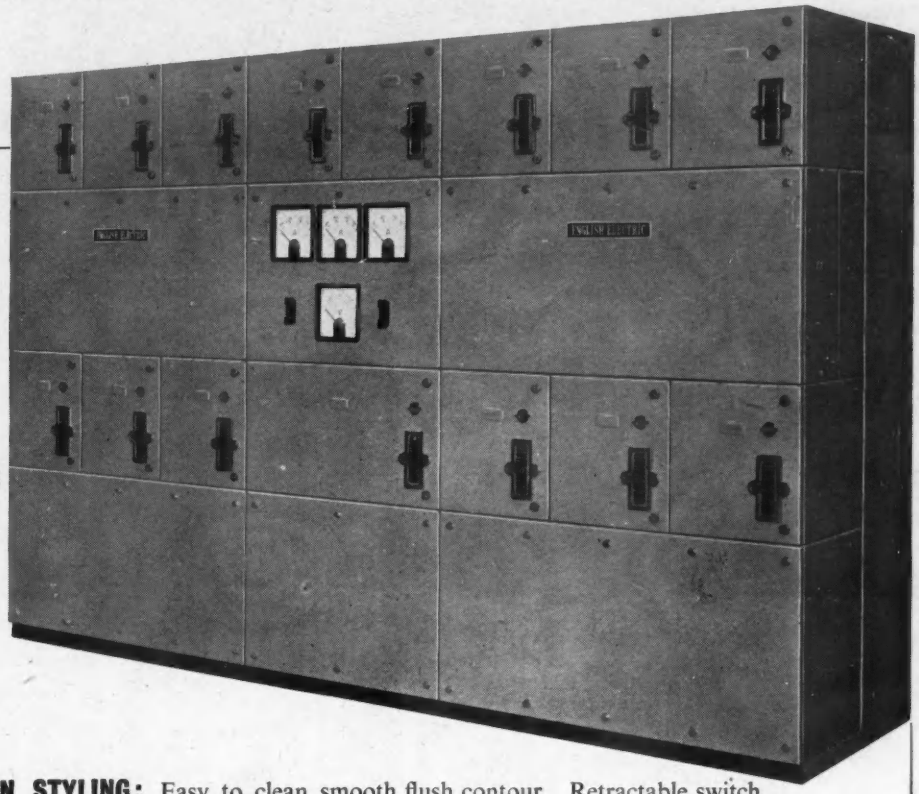

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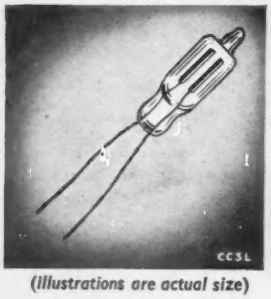

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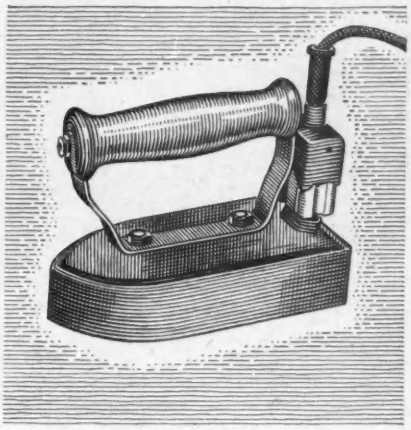

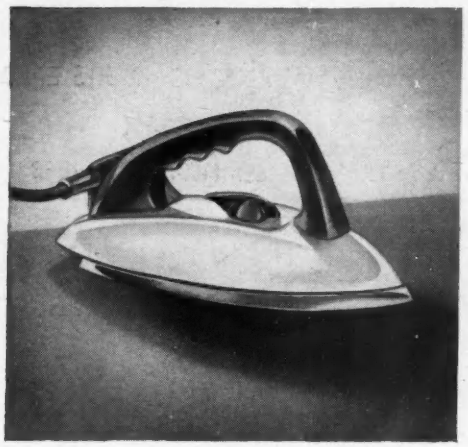

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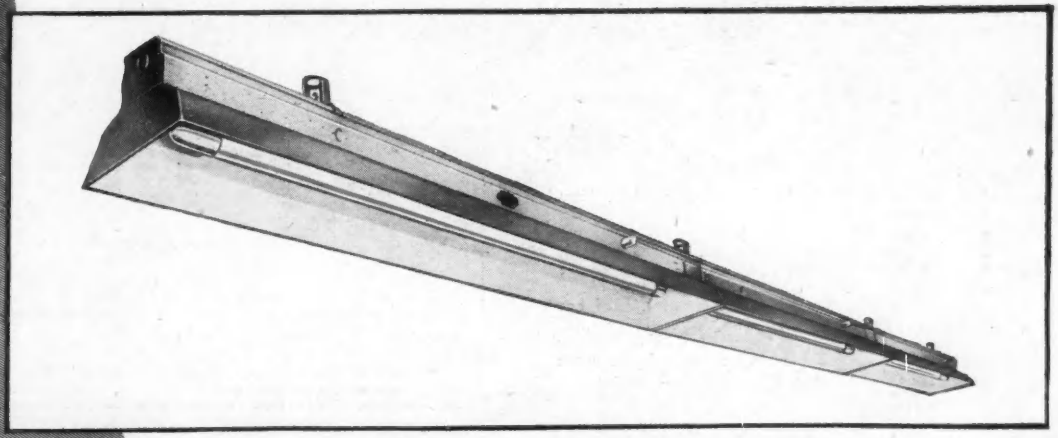

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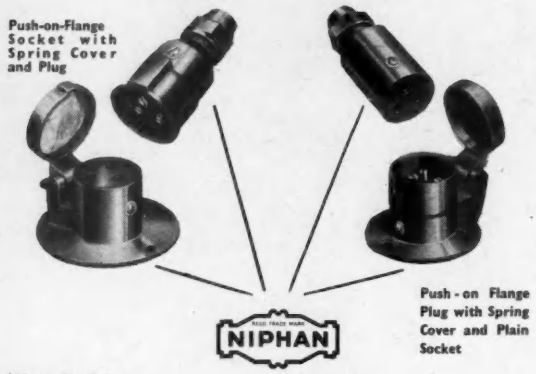

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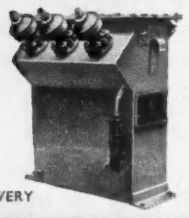

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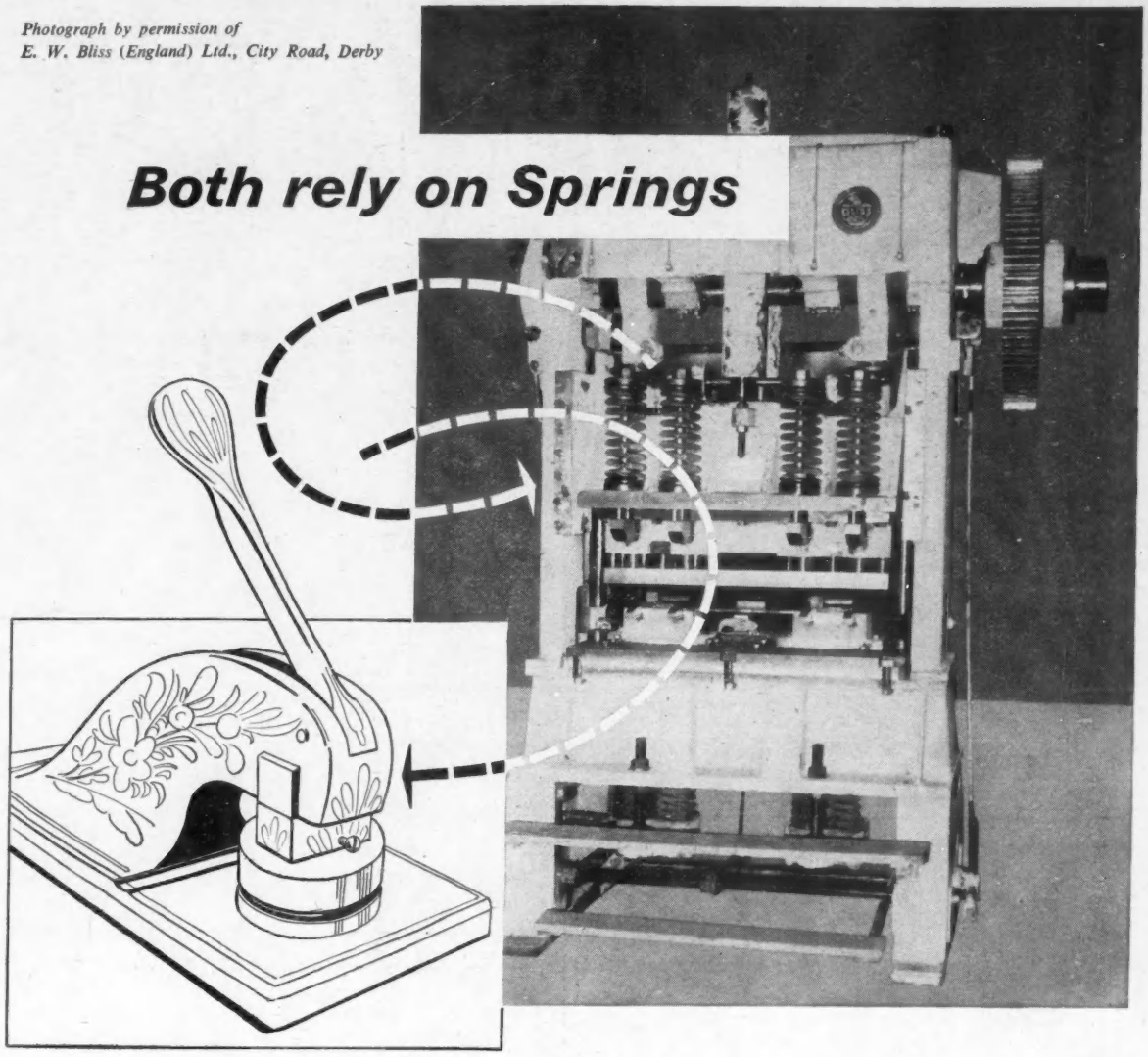

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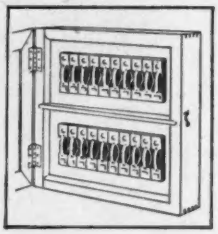

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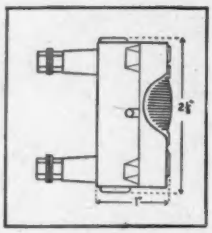

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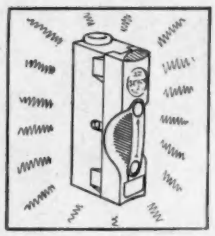

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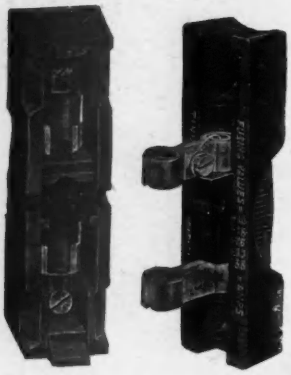

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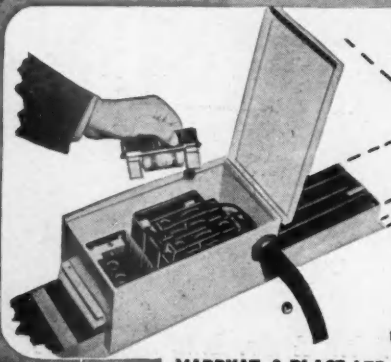

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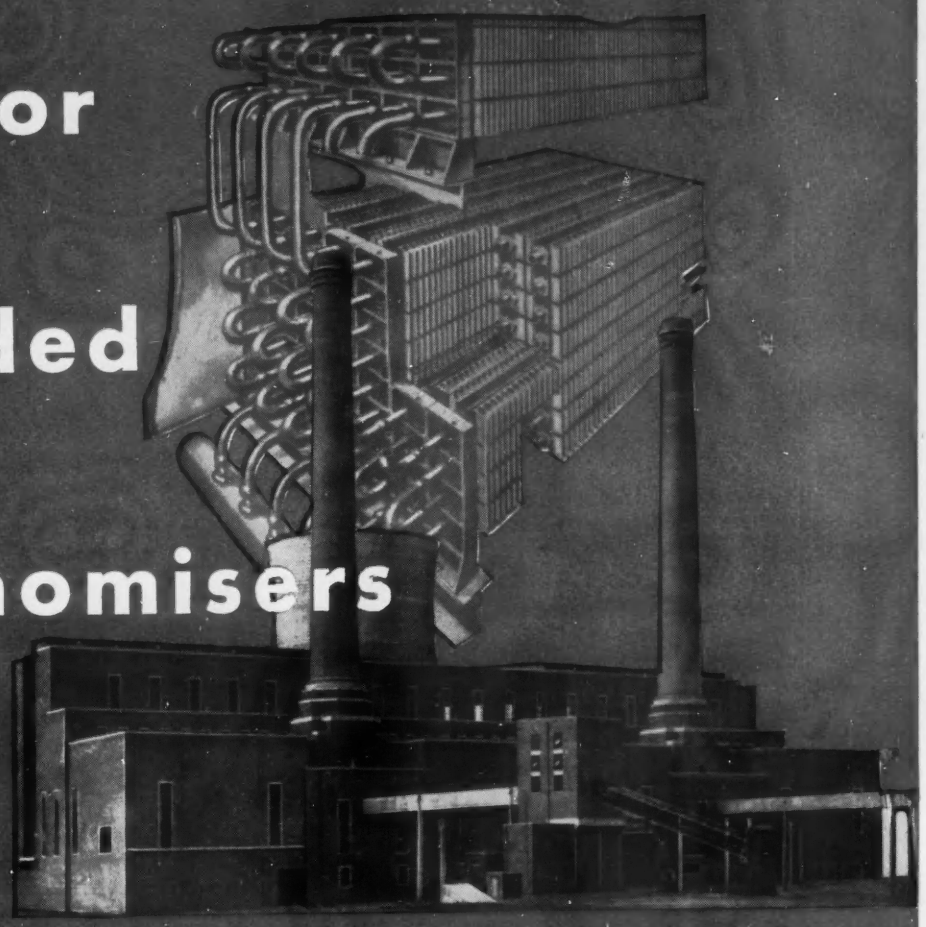

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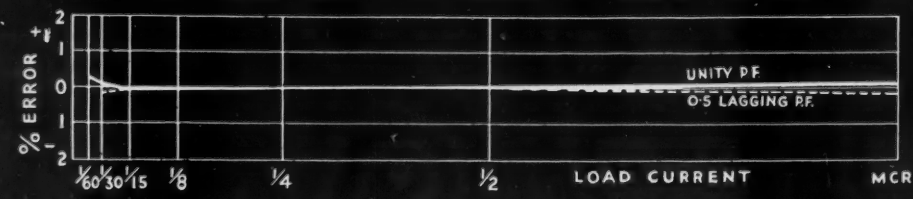

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